

● on what earth are you thinking?

Reimagining the relationship between
architecture and ecological systems
in the context of climate collapse

Byera Hadley
Travelling Scholarships
Journal Series

Eleanor Peres

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Byera Hadley, born in 1872, was a distinguished architect responsible for the design and execution of a number of fine buildings in New South Wales.

He was dedicated to architectural education, both as a part-time teacher in architectural drawing at the Sydney Technical College, and culminating in his appointment in 1914 as Lecturer-in-Charge at the College's Department of Architecture. Under his guidance, the College became acknowledged as one of the finest schools of architecture in the British Empire.

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Eleanor Peres was awarded the Byera Hadley Travelling Scholarship in 2018

Cover image: Junya Ishigami Art Biotop 'Mizuniwa' Water Garden in Nasu, Japan Photograph by Eleanor Peres.

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Architecture and Ecology share a tense relationship where the former often dominates the latter by carving out artificial environments that rupture flows in interconnected networks of biodiversity and form patterns that segregate the human species as dominant over others. From eight Cities, this research shares design and policy ideas that are reimagining this fractured friendship.



foreword



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This research was instigated by a stark and grave realisation that too many of earth's species are disappearing at a frightening rate. Despite the fact cities have become the dominant preference for human settlement, ecologies of peripheral landscapes are becoming increasingly threatened by industrial infrastructure that supplies the human city with its energy, technology and food and relieves it of its waste. On what earth are you thinking?

This is a complex imbalance that cannot be addressed from a single scale of perspective. Rather, we must confront the critical environmental challenges we face in 2020 by embracing complexity in its various scales; the microscopic nature and interaction of species, the macroscopic network of urban planning and infrastructure as well as the intermediary space where architecture projects and ecological communities intertwine and overlap.

'On what earth are you thinking?' is a Byera Hadley travelling research project that positions itself within that intermediary scale to demonstrate how architecture - a symphony of people, skills and practices spanning engineering, construction, development, material science and landscape - can enact a more reciprocal relationship between artificial structures of design and the ecological landscapes they inhabit and alter.

The project embraces the urban nature of ecological degradation in order to demonstrate alternative practices for architecture. From March through June in 2019, I followed spring around earth from Sydney through Asia, Europe and the United States of America to eight case study cities in search of exemplary interventions of both design and policy. A series of realisations on all three scales - microscopic, intermediary and macroscopic - offer conclusive insights to the layered state of this topic.

In each of the **eight case study cities** - London, New York, Berlin, Rotterdam, Amsterdam, Milan, Paris and Singapore - the research reviewed the macroscopic planning policies as well as two intermediary projects to better understand the microscopic implications. From eight city planning documents and sixteen architecture interventions, the project amounts to a taxonomy of design and policy ideas that reimagine the fractured friendship between architecture and ecology. Across political borders, scales and architectural typologies, ideas for ecologically engaged structures have been summarised in **Tools for Reciprocity**. Consider this as an all-star fantasy league of ecological architecture, intended not only for architects and their consultants and communities but for anyone engaged in the future of earth. These tools will lead you in the direction of case studies that illustrate their application.

This research does not propose a regression to historic methods of land management nor a revitalisation of 'nature' as a wild other beyond the city. Instead, it proposes that the protection and proliferation of ecosystems is deeply embedded in the same complex web of both metabolic and technological systems that cities comprise. If the future has not been cancelled yet, a transformation of the pressure human activity places on earth must begin. The question is whether policy can effect change for projects to follow or whether demonstration through projects is actually forcing a transformation of policy. This research proposes the latter to be more capable of producing tangible and quantitative outcomes but acknowledges that the scale of demonstration through individual projects requires expansion. Automation and its infrastructure must be embraced. How you read this report is entirely yours for choosing; take only the tools for reciprocity, read the realisations essays, jump to the case study you find most relevant or sink into the entire collection of eight cities as your mind desires.

contents



this page & opposite: communal water stream runs from mountain catchment via street side to a well on each property on Naoshima island, Seto Inland Sea, Japan

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Introduction

this page: 'Earthrise' image taken on Apollo 8 in 1968 (above) and 'Blue Marble' December 7, 1972, from a distance of about 29,000km from Apollo 17
opposite: Thomas Cole's five piece painting series 'the Course of Empire', New York Historical Society



6 Over fifty years ago humans were confronted with a perspective of earth that dissolved any recognisable form of individual, building, highway, town, city or border. Orbiting space at hundreds of thousands of kilometres from the planet we inhabit, Earthrise in 1968 and Blue Marble in 1972 turned the camera lens back to earth to reveal a vibrant landscape of scattered islands in a sprawling ocean laced with hovering clouds. The composition of an atmosphere capable of sustaining life suspended in darkness is both beautiful and dangerous.

The seduction of these images illustrates the overview effect¹, a cognitive shift in perception that generates a profound reaction to viewing earth outside its atmosphere and has been linked with the Japanese concept of Yogan that describes at once a mysterious sense of the beauty of the universe and the sadness of human suffering. The psychological effect of the whole from without is an individual and personal reckoning. What the images conceal is the complexity of human difference brewing beneath the atmosphere that was characterised in the late sixties and early seventies by the space race staged between the Cold War superpowers USA and the USSR.

Today these complexities are staged in various attempts for humanity to collectively envision its future on that spherical whole, embodied by those photographs in the context that natural systems are proving to be in a state of collapse. A state of crisis. Things are not what they seem, but every nation has a 'plan of action'. Threatened with its own demise and enamoured by an

anthropocentric attitude, the world is asking itself what measures can be taken to avoid total bleaching of the Great Barrier Reef or eradication of the Amazonian rainforest and all its biodiversity. An unequal distribution of rights between earth's species has been uncovered, and the leading advocates of rebalance are youth citizens² with no right to political voting and limited ability to partake in economic exchange.

"[Thomas Cole] was one of the first to grapple with portraying the consequences of altering nature to meet

*human needs and desires. In later years, others would reflect upon similar concerns, and some would take action."*³

In New York in the 1830s the landscape painter interpreted the evolution of the conflict between liberty and power in the painted quintet 'The Course of Empire', pictured. Cole transformed the landscape genre from a reflective art to a medium of expressing historical, social and political theory.

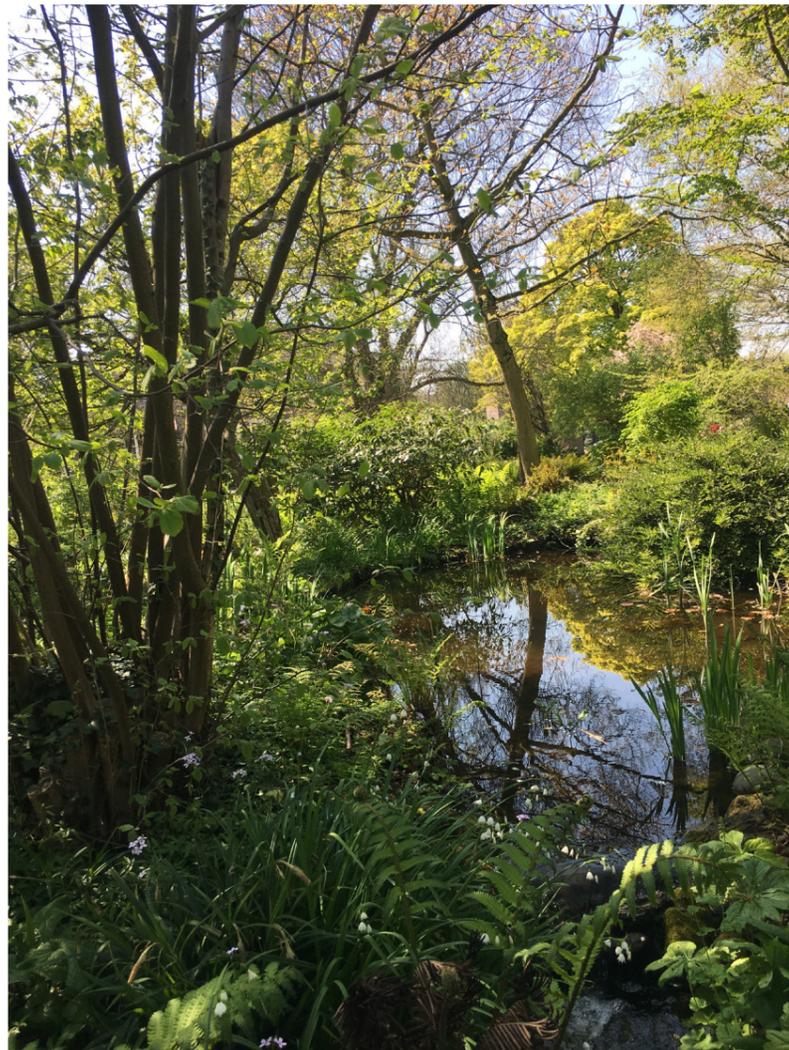
I intend to spare you the flight of **sustainability**, a lofty and often partisan journey that almost never lands, and instead invite you on a retrospective expedition following spring around the world in search of artificial structures, projects, objects and systems designed to sustain living systems. But before I remove it from the agenda, I will put this popularised term on the table for a moment and indulge in its distraction. Sustainability entered common discourse as the focus of the Earth Summit held in Rio de Janeiro in 1992;

*"Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can - in a global partnership for sustainable development."*⁴

From this point on, the term has been applied like rationed cordial and watered-down in Corporate Social Responsibility (CSR) acts that conceal its true definition⁵, the ability to exist constantly. An ecosystem⁶ is a community of living organisms in conjunction with the non-living components of their environment, interacting as an interconnected system. The very word ecology derives from the Greek 'oikos' which means house and, in a sense, is a concept where both the rules of the house apply and where comfort and retreat are provided. In 'Being Ecological'⁷, Timothy Morton frames the ecological house as a weird one where the roof is perforated, the walls are alive and retain all kinds of visitors we might not want to welcome and where other houses seem to be overlapping with ours. Ecological will take the place of sustainable from here.

Time and scale are the two metrics on which we will explore how humanity plans to ensure its own survival on earth, let alone the emergence of disappearing species with which we share it and on whom we rely. Time permits a developed understanding with reference to performance of the past and projections toward the future. Time has armed us with the knowledge that the number of Homo Sapiens inhabiting earth has tripled⁸





in the last seventy years and the global population in urban environments increased from thirty percent in 1950 to over half in 2014 and is expected to reach seventy percent by 2050. Time also reveals that many national plans for environmental stewardship gravitate around the incentive set by the Intergovernmental Panel for Climate Change⁹ to maintain a surface temperature of earth to below 1.5 degrees Celsius, a concept as behemoth as the earthrise images captured from space. Collating thousands of scientific research documents as evidence, the 2018 IPCC publication Global Warning of 1.5°C warned that temperatures have increased one degree higher than pre-industrial levels and a further one degree would graduate earth into catastrophic and irreversible territory where the number of plants projected to lose their habitat would double.

The global population suffering water scarcity would also double and only one percent of all corals would remain. Remaining below the threshold of 1.5°C will require global emissions to peak immediately and continue falling until they reach net-zero as soon as possible. Business as usual will not cut it. Despite data collection on **known** species only emerging as a practice around 1950, most Cities plan to have protected biodiversity, resolved inequality and overcome fossil fuel energy reliance by 2050. Between 1950 and 2050 many things have happened, and many have not, many promises have been made and many plans have been hatched.



this page: trees pulled upright on campus at Tongji University, Shanghai
opposite: Eleanor Peres travel itinerary for Byera Hadley scholarship research 'On what earth are you thinking?'

How on earth are we going to do this? And on what earth are we thinking? As day-to-day changes in weather patterns amass to droughts, fires and floods that can no longer be ignored, public awareness has reached a tipping point and civic action is picking up in Cities around the world. But these varying protest movements, organisations, campaigns, and events are confronting the crisis by adopting a language of urgency, fatality and catastrophe. It is no wonder the most common response to the situation is either denial or depression.¹⁰

Scale reassures us that the whole world at once cannot perceive a scenario as interconnected and complex as the ecologies it threatens, just as any individual cannot at once be held responsible for their everyday actions. Where is the sweet spot between the single and the whole, between then and when? As collective bodies in cities that gather in international round tables, we make commitments to how we will live in the future but how do we visualise, understand and experiment with how to live through the transition with care?

On what earth are you thinking? is a detailed account of eight Cities and the commitments each one has made to participate in the design of the future. Elements of what has shaped these incredibly different geographic zones are laid out as a framework from which you can draw context for the intentions of planning promises and design gestures. From each destination two intermediary architecture projects have been selected that represent engagement in the continuity, connection and repair of diverse ecologies amongst urban fabric.

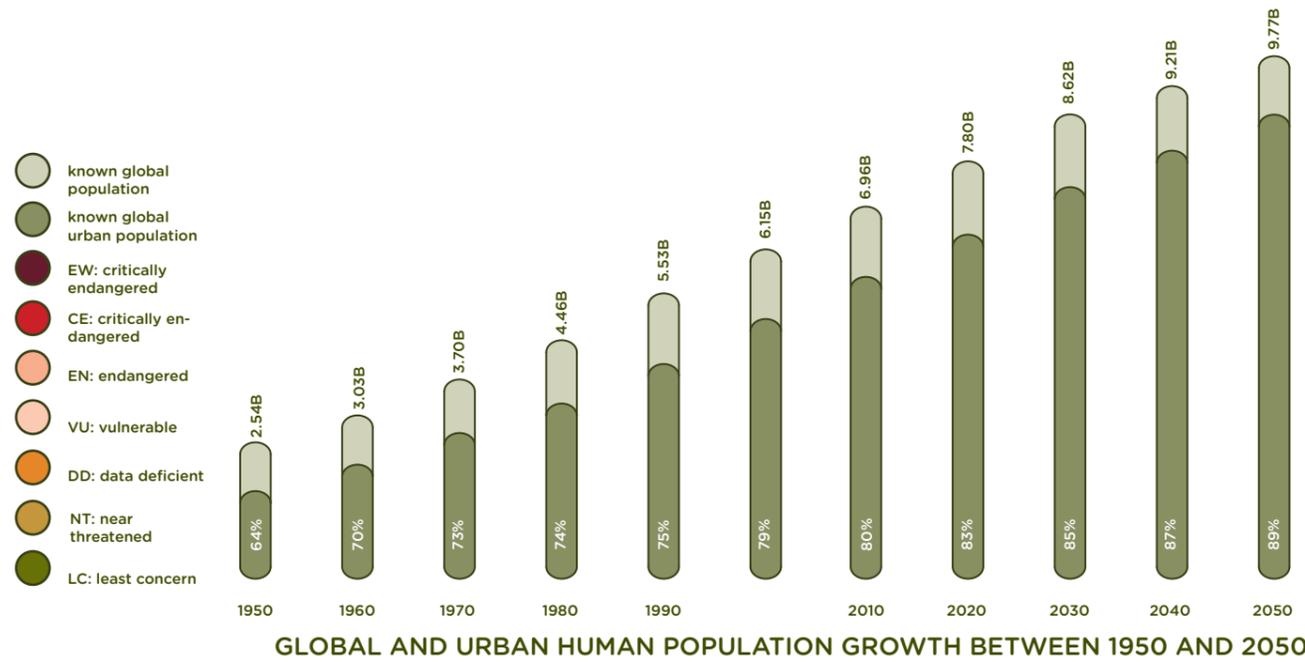
The methodology of this research positions architecture at a scale of reference between microscopic individuality of species and macroscopic urban planning. Architecture, the artificial structures that are traces of human behaviour among a natural order, have become layered and complex with passing time. As the human population multiplies and migrates to dense urban environments, the erasure of natural species and ecosystems continues.

As a I travelled westward around earth, certain pattern conditions revealed themselves that came to form a series of realisations or conclusions at work on various scales. On a microscopic level, 'imbalance of growth and erasure' explores how species other than human are learned about, protected and advocated for by breaking down their disappearance. 'Ecologies are not one colour' places architecture in dialogue together with ecology on an intermediary scale between the miniscule and the massive where tensions and fractures in their relationship can emerge.

The colour green is taken advantage of by every city, sector and planning policy, including architecture, in a style that oversimplifies the diversity of what artificial structures, architectures, can learn from ecology in becoming more synonymous with their urban atmospheres. On a macroscopic scale, 'city limits and the engineered wild' challenges a common perception of cities as that life contained between borderlines on two dimensional maps and instead frames the urban centre as an organism powered by technology and transit routes that feeds and offsets itself in faraway landscapes beyond the delineated border.

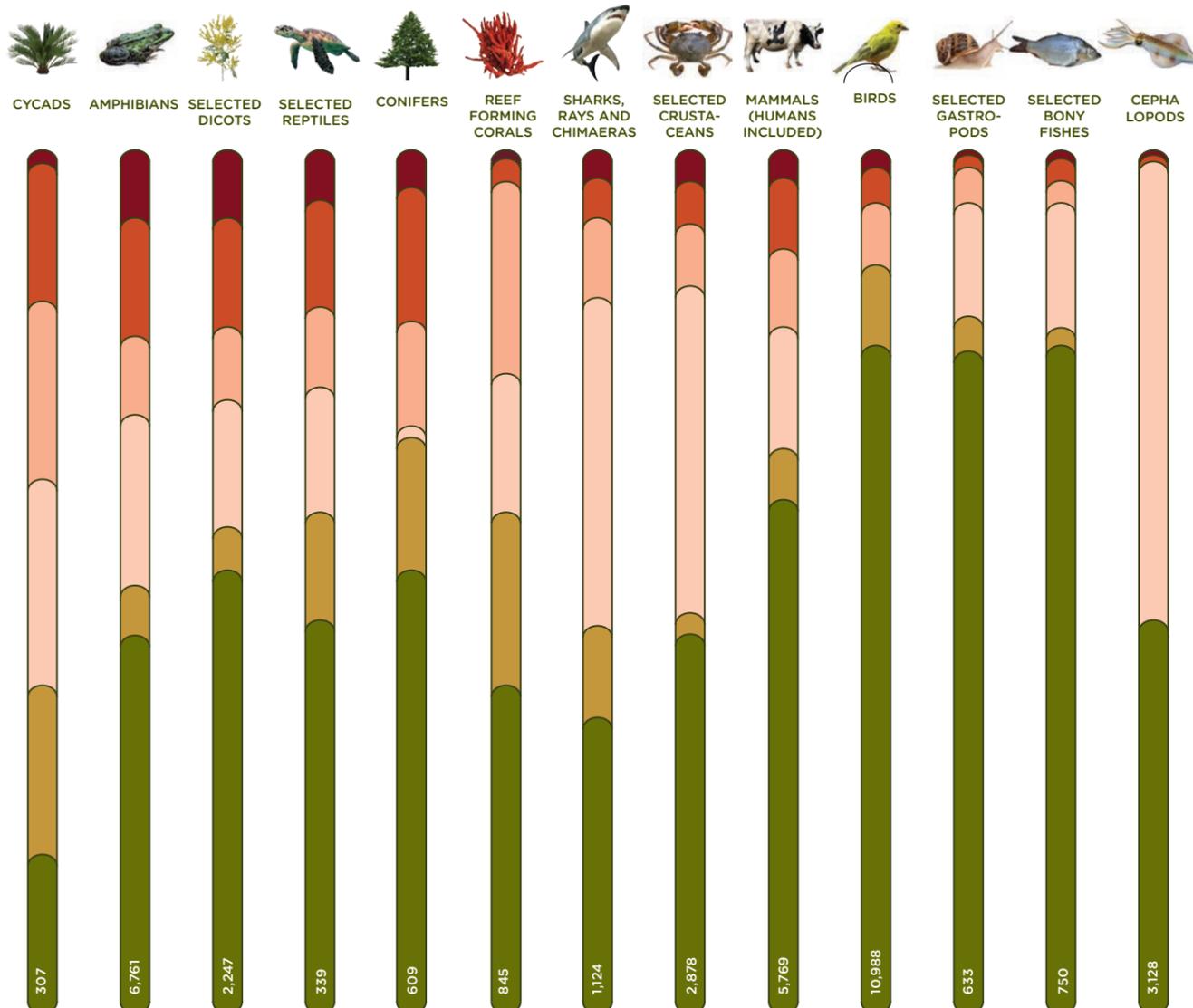
Microscopic: The Imbalance of Growth and Erasure

this page: Inujima Life Garden by Akarui Heya Landscape architects, Seto Inland Sea, Japan
opposite: diagram of population human population growth and urbanisation compared with condition of species by category



10

STATE OF SURVIVAL OF EARTH'S SPECIES BY TAXONOMIC CATEGORY



FIGURES represent total number of species assessed



One hundred ecological communities¹¹ have been identified as threatened in New South Wales, where the human population is expected to increase eighty percent by 2054. This unprecedented contrast in growth and erasure of the territories we live in is not a local condition but a global phenomenon of urbanisation. How can design empower those that experience it to find beauty in rebalancing contrasting population patterns of humans and threatened species in the densification of our cities? But first, where lies the imbalance?

United Nations Sustainable Development Goal (SDG) fifteen of seventeen, Life on Land¹¹, demands the maintained management of forests and the active reversal of desertification, land degradation and biodiversity loss. It sets twelve qualitative targets to be resolved by 2030 that interconnect with the sixteen other Goals¹² to address how the global population could address; poverty, inequality, crime, environmental degradation, prosperity, peace and justice. The call to action is to; restore, combat, conserve, promote, halt, reduce, protect, prevent, promote access, share, end, eradicate and mobilise.

Estimates of the total number of species alive on earth vary enormously. There are over one million known species on earth and over eight million estimated, discounting bacteria and microorganisms. The unknown count was determined in 2011¹³ by an international research collective that studied the relationships between species and their external interactions. Over eighty percent of land species and more than ninety percent of aquatic species are yet to be discovered.

Discrepancy between the figures known and estimated leans heavily toward the animal kingdom, which accounts for only twelve percent of what is known but over ninety percent of that estimated. Plants, on the other hand, account for seventy percent of known species and less than one percent of the estimated total. Smaller organisms that live in harder to reach place, like the ocean's depths, are believed to account for a great portion of the unknown. Despite conservation efforts ranging in scale from local volunteer land-care to international bodies like the International Union for Conservation of Nature (IUCN) Red List¹⁴, many unknown species might face extinction before resources can be allocated to their discovery.



One third of all known species on earth, according to the IUCN Red List, are threatened with extinction, including 40% of amphibians, 34% of conifers, 33% of reef building corals, 25% of mammals and 14% of birds. Here in Australia¹⁵, the number of known species nears one hundred and fifty thousand, including; 98,703 invertebrates, 24,716 plants, 11,846 fungi, 8,128 chordates¹⁵ species and around 4,186 others. The department of Environment and Energy admit that over three hundred animal species and almost twelve hundred plants are threatened with extinction. More than eighty percent of mammals, forty-five percent of birds and almost ninety percent of inshore fish are endemic to Australia¹⁶, which means they can be found nowhere else on earth.

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"We know very little about the species with which we share the planet; and we are converting the Earth's natural landscapes so quickly, with total ignorance of our impact on the life in them." - Professor Jonathan Baillie, director of conservation at the Zoological Society of London (ZSL)¹⁷

All human beings, Homo Sapiens, account for a single species among six thousand others in the mammal group of animals. Yet we reign supreme. Since 1900, the world's population according to National Geographic¹⁸ has more than tripled, from 1.6 billion to 7.2 billion people, while the number of towns with over eight million inhabitants soared from two to forty-two. The global population living in Cities shifted from thirty percent in 1950 to fifty-four percent in 2014 and is expected to reach nearly seventy percent by 2050. We have altered earth's landscape drastically.



this page: ancient agricultural practice of local farming on Ithaki island, Greece
opposite (top): Stari Grad UNESCO world heritage agricultural landscape, Croatia
opposite (below): 'A tree falls in Hudson Yards' Trisha Donnelly's work in the Sheds Gallery, New York City

13

It is estimated that ten million square kilometres of forest has been lost since the beginning of the twentieth century and between 1990 and 2016 alone, an area larger than South Africa. According to the Guardian¹⁹, an area of forest equivalent to a soccer field disappears every second. In 1995, New South Wales implemented the 'Threatened Species Conservation Act' which only in 2016 was replaced with the 'Biodiversity Conservation Act'. This shift in consideration from the singular to the plural places necessary value on the relationships a species has in its environmental context, what it requires for its own survival and in turn what reciprocal services it engages in with its surroundings.

Every species operates within its context and the survival of each relies on understanding and curiosity at a larger scale than the individual. Just as thriving ecologies contain complex and reciprocal interactions that ensure their survival and resilience, so too do the heterogeneous and dynamic social functions of a Metropolis define people's lifestyle and wellbeing. The difference is that Cities are highly modified and extractive systems whose planning, design and operation place pressure on the ecosystems that surround and traverse them.

"Urban ecology conceptualises Cities as ecosystems. It recognises that humans are inseparable from nature. Of particular importance is the interaction between humans and the rest of biodiversity and the impacts of urbanisation on biodiversity. The science of Urban Ecology requires an integrated approach in which Cities are viewed as complex and dynamic systems that encompass the natural environment and social and technological consideration"
- National Green Infrastructure Network²⁰

Microscopic interactions of ecological communities collectively perform macroscopic environmental services to Cities. The extensive benefits of Urban Ecology for both human and native species populations, according to the National Green Infrastructure Network include; reduced acid rain and urban heat island effect, air purification by vegetation, stormwater management, carbon sequestration, financial savings incurred through passive heating and cooling, minimisation of extreme weather, lowered health risk, improved productivity and protected biodiversity. But we must tread carefully with such promises.

Agricultural scientist, ecologist and landscape architect Margaret Grose²¹ warns against the commodification and monetisation of 'ecosystem services' as a resource pool from which human environments can benefit. Nature cannot engage in the human construct of capital; its systems cannot be accommodated in the marketplace and it cannot bargain on its own behalf. Grose urges us not to constrain our ability to imagine and design reciprocal systems for living by favouring 'natural capital' and 'ecosystem services' over 'biodiversity' and 'nature conservation' in discussion of policy engaged with the living world. To the theme of 'Broken Nature', a fictional 'Nation of Plants', the most populous, widespread and enduring on earth, delivered a captivating address to the United Nations congress, beseeching visitors to the exhibition to listen and think with attention and wisdom about the following;



"The planet we have is alive because of us. Water, oxygen, the climate all depends on us. We are the engine of life. Be fully aware of this. Over time you have learned to use us. Everything you eat comes from us. Your most important energy resources come from us. We provide you with building materials, textile fibres, colours, beauty and health. You have learned very well to use what we produce. But now the moment has arrived for you to also use what we can teach you." - the Nation of Plants, Milano Triennale 2019²²

In architecture and planning, and in our own imagination, it would be of mutual benefit to open our practices to the eight million or so other species we share the planet with. For the sake of designing how to do this, if diversity is to survive, we must do so beyond the need for financial gain. Nature is not a service we can call to arms in times of destitute. Its army cannot photosynthesise at a faster rate than the sun will rise and fall. If we enquire how other species manage life on earth however, that curiosity might help repair the imbalance of growth and erasure in the ways that have been promised in city plans and across political borders in international forums. The populous City of the future can learn from the vast unknown.

top: morning smog over the Black Forest in Emmendingen, Germany
left: educational wayfinding station on the survival state of species in Kew Gardens, London



Intermediary: Ecologies are not one Colour

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Ecology and architecture are two very different pathways from which the intermediary scale between microscopic imbalance and macroscopic urbanisation can be approached. Although both disciplines engage in the orchestration of diverse participants through systems and relationships, ecology does so through observation and analysis of the existing while architecture brings into existence interventions of design.

There is no modern or post-modern ecology that translates manifestos of political and creative culture into wetlands or forests but there are architectural inventions from these movements that enclose and elevate the human population from other species. The shopping mall, high-rise tower, highway, automobile and personal mobile phone might be considered the ultimate monuments of anthropocentric enclosure of the protected human.

“Our way of life is still based in twentieth-century ideas. Specifically, a modernist philosophy that assumes we can use science and technology to conquer nature. So we try to isolate ourselves from nature; our cities are completely segregated from the environment. That kind of modernist thinking has reached its limit.” - Toyo Ito²³



this page: reflections over the timber-producing Japanese town Yoshino
opposite: morning dew licking the aquatic plants of the Yoshino riverbed

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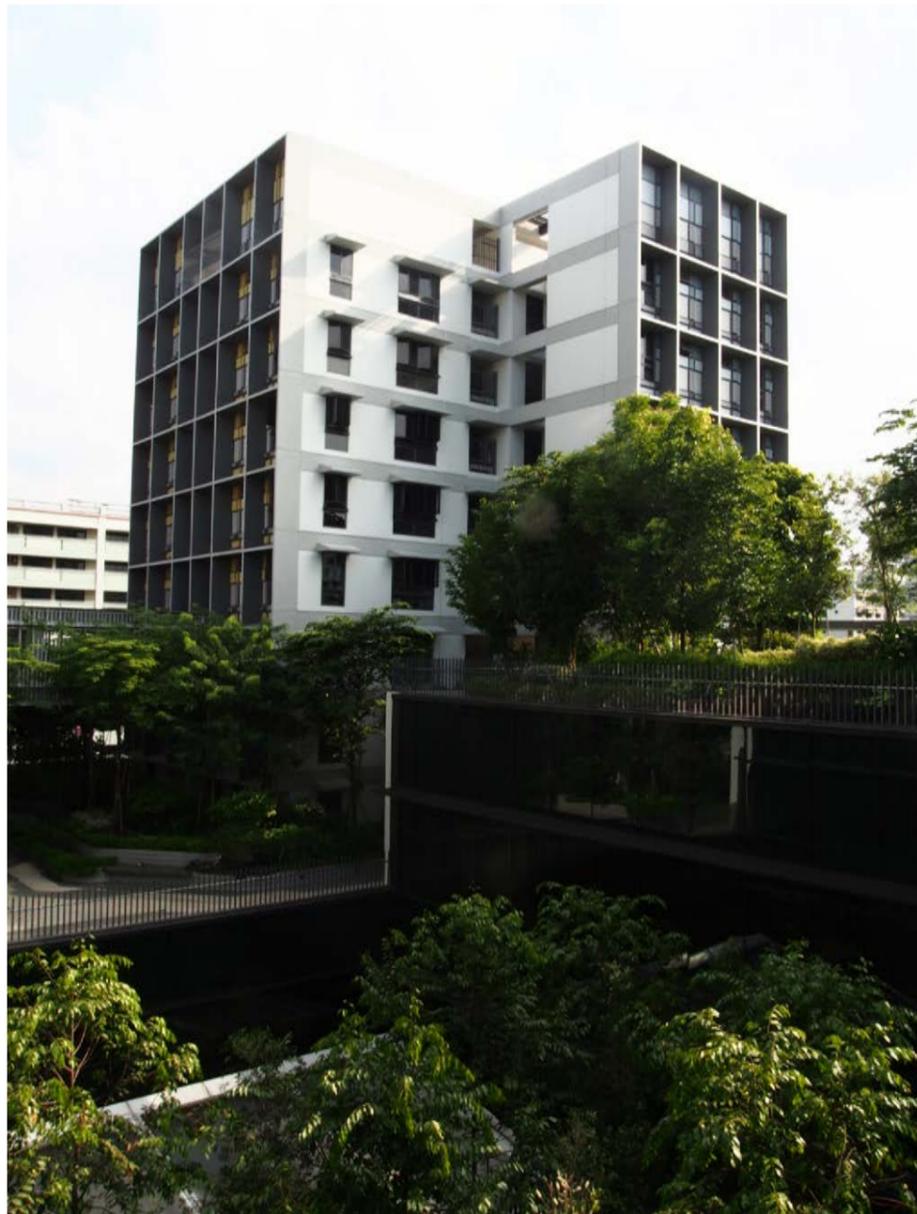
“Ecologists began to explore the city as an object of research and made a start with the identification of specifically urban ecological systems, species and habitats. Based on that knowledge, the specific expertise of urban ecology gradually

Ecology was first described one-hundred and fifty years ago by the German zoologist Ernst Haeckel as “the relation of the animal both to its organic and inorganic environment”²⁴. The scientific studies of ecologists throughout the twentieth century ranged from plant communities’ composition, structure and distribution to energy budgets and the dynamics of communities and populations. In 1920 the freshwater biologist August Thienemann introduced the concept of trophic levels by which food energy is transferred through a series of organisms from plants as primary producers of photosynthesis to secondary and tertiary animal consumers.

Plants and algae are **autotrophic** which means they produce their own food by using the sun’s energy to turn carbon dioxide and water into carbohydrates in their leaves. All other species, including you and I, are heterotrophic because we feed off complex substances initiated by the work of autotrophic plants. Decomposers in the form of insects, fungi and microscopic bacteria complete the cycle by consuming and breaking down excretion, dead plants and animals into basic nutrients that are returned to the ecosystem. But how do humans, architecture and the city factor into this cycle?

formed, although the first urban ecologists weren’t appointed until the 1980’s. The focus of their work is advancing the natural management of the urban. The next step, intervening in urban ecology by adapting, improving and adding, in other words by designing and creating urban nature, is at this moment still at a pioneering stage.”²⁵

Cities host a wide variety of living conditions, from rivers with flood plains, coastal shores, lakes, tributaries, buildings of various densities and heights, lawns, trees, city parks, pocket parks, median strips, forests, kitchen gardens, playgrounds, ponds, ditches and abandoned overgrown plots. Disconnected patches of biotopes in the urban fabric function as an archipelago, where built fabric acts as the dividing water body that can inhibit the continuity and connection between islands of biodiversity. The porosity of the urban mesh in materiality and form is critical to ensuring the development of a diverse and interconnected urban ecology. Individual architecture projects provide opportunity for interconnection and continuity between disconnected landscapes and energy systems of the city such as water flow, food production and waste management.



this page: Kampung Admiralty aged care housing and mixed-use development in Singapore by WOHA
opposite: De Ceuvel share working community fabricated from retired houseboats in Amsterdam by Space & Matter

“Diversity and complexity are important conditions for a more resilient system. A monoculture, such as a beautifully cut lawn or a crystal-clear pond without vegetation, may have its own aesthetic value, but is also sensitive to disturbances and requires many interventions in the form of maintenance. A rich and complex biotope, on the other hand, is self-perpetuating, because there are no dominant species.”²⁶

This essay invites a critical reflection on the colour green, often taken out of context as a static exploitation of the benefits reaped by the autotrophic work of photosynthesising plants. Ecologies in urban

environments are polychromatic worlds where you might spy ochre earth, copper clay, mud soil, black sand, eucalyptus bark or scarlet banksia. They are in flux, experimental and imperfect testing grounds where the expertise of biologists, horticulturalists, ecologists,



landscape architects, architects, planners and people overlaps. Some elements might thrive and others might die and the system needs to be engineered in an open-ended manner that responds to changeability, seasonality and the conditions that surround it. The experiment begins with an inventory of what currently exists or what once existed in that place, followed by a prototype that allows testing of a concept across transitional shifts of seasons and patterns of change. Design with nature is learning from the ecological method of observing what already exists before investing in a total intervention.

“Although planning goals can be described and designed quite precisely in an urban system, in many ways designing and creating nature primarily means creating the right conditions for a natural process of inhabitation, growth and adaptation. The result is a system that over the course of time evolves through appropriation, not a product with a clear final stage or date of completion.”²⁷

This collection of eighteen case studies aims to frame the intermediary scale where architecture and ecology can interact in a mutually beneficial way in the design, programming and ongoing activation of urban sites. Both timeless and experimental typologies of architecture are captured in the research. The timeframe cover projects completed between 1964 and 2019, from the sprawling

social housing of the Paris Banlieu Ivry-Sur-Seine designed by Renee Gailhoustet and Jean Renaudie to the School of Design and Environment at the National University of Singapore by Serie Architects, the first net-zero energy building in the tropics that opened its doors to the first cohort of students in early 2019.

Both familiar and experimental typologies of program and land use are represented in the study, from the royal botanic gardens and herbarium research facilities of Kew in London to Floating University, a satellite postgraduate education platform occupying the overflow dam of the former Templehof airport in Berlin. There are examples where ecology is left to its own devices and others where those who visit and use the site are deeply active in participation, from a circular workplace of retrofitted houseboats that leave the ground to plants on a former shipyard in Amsterdam to Oystertexture where SCAPE studio have partnered with students of the New York Harbor School, local residents and planning agencies to regenerate an complex underwater community of the bivalve molluscs that also serve as breakwaters for wave attenuation and invite harbour recreation. No single project is an ideal case study for ecological architecture, it is the combination of these ideas that together allowed a pattern of repeating ‘tools’ to emerge. A plastic bag could be understood to be a single

Macroscopic: City Limits & the Engineered Wild

20 object sitting in your kitchen cupboard but could also be conceptualised as tiny particles broken down in the ocean that have made their way into the digestive systems of aquatic species. Zooming out, a plastic bag encompasses all plastic bags that have ever been manufactured, used and discarded regardless of whether they find themselves now in homes, landfill or floating in water. This is the type of impossible concept Timothy Morton calls **Hyperobjects**²⁸. Climate change is another hyperobject.

The temperature dropped three degrees this afternoon as the cloud cover came through, the difference was perceivable because I recall putting on a jacket. But the moment ice began melting on the continental shelf was out of sight because it happened in a different time frame than something recognisable. Even if I could sense it, like the pause between one song finishing and the next beginning, I would have had to sit for days and seasons and years to perceive how it changed. The macroscopic scale is the most intangible to perceive and the larger it gets, the more generalised its content becomes. It is this scale at which planning promises are set because it delocalises massive concepts like city and agriculture as networks that can be perceived, discussed and reimagined regardless of their context.

“The global climate model is actually a series of sub-models that are refined until they capture the causal structure of the climatic problem to be reproduced. In climate modelling, as in other forms of simulation, the trick is to somehow reproduce enough information to catch what is relevant in a problem - no more, no less.” - Adrian Lahoud²⁹

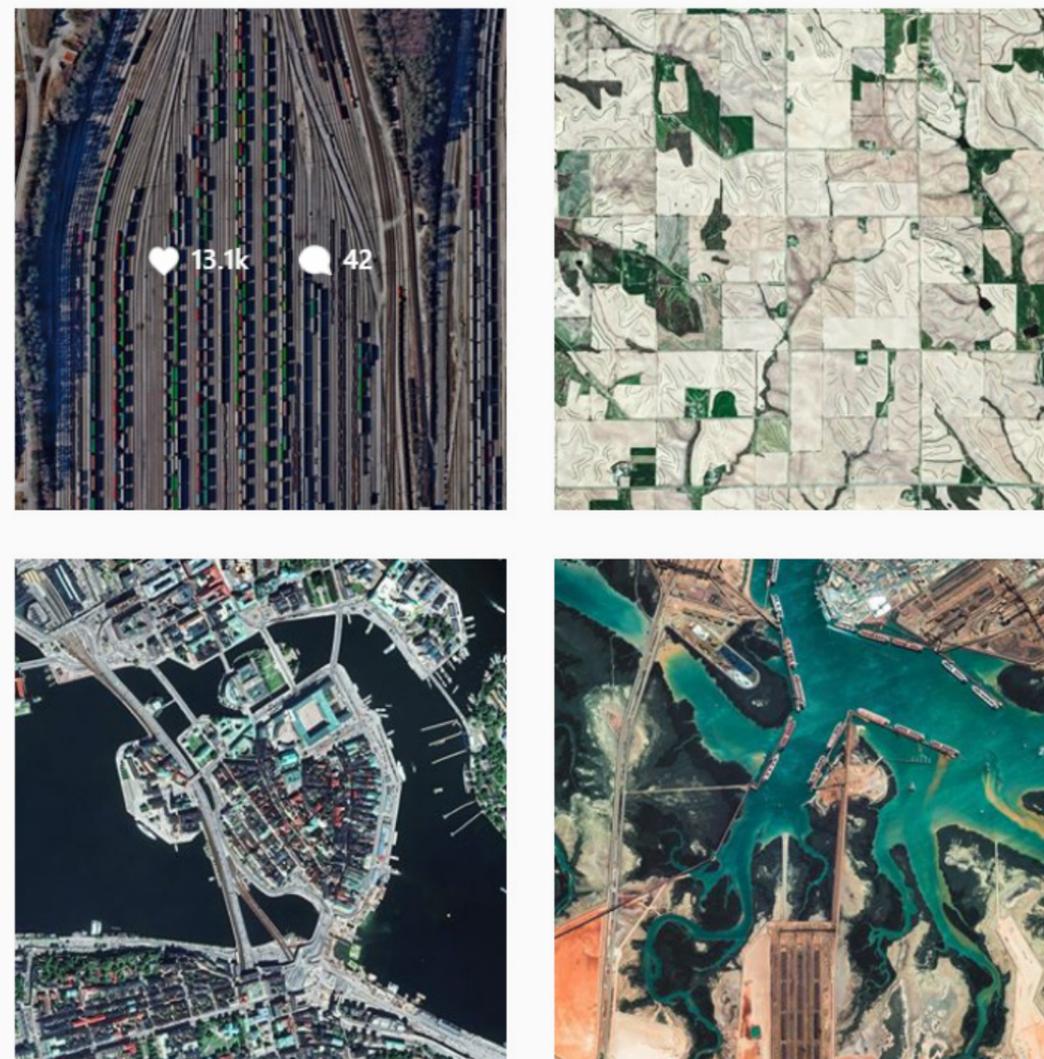
Humans first built nomadic shelters as a protective layer between themselves and the dangerous otherness of the wild, almost like a large item of clothing or a tent. Over time the design of shelters has developed into a complex network of landscapes and economic exchange where raw materials extracted in one place are manufactured

in another, transported through others to factories that fabricate proprietary products on behalf of businesses with offices in another place to be installed in yet another place to make a home somewhere else. When the home is run down or old, those materials are pulled down in one place and taken to another place to be reused or discarded of in another, often unknown place.

“Creating space can be seen as the creation of security and safety. Security is a situation brought about by architecture functioning as a heat-retaining skin. Safety is the awareness that the spatial rigidity of the material will ensure that negative external influences, such as rain, cannot force their way in. This basic architectural logic can be applied at all levels of scale at the same time; national borders, cities, districts, neighbourhoods, blocks, houses, rooms, the corners of rooms, blankets and individual pieces of clothing. These spatial units should not be distinct from one another, but as a totality shaping our comprehensive spatial context.”³⁰

The transcendental wilderness of America brought to our collective imaginations through Thoreau's 1854 novel **Walden**³¹ and the 1992 disappearance of Christopher McCandless³² in Alaska delivered a warning of naivety to the lone human in a dangerous wild. Prior to 1995 less than forty-three percent of earth's surface had experienced human-induced degradation but as of 2008³³ over seventy-five percent of earth's ice-free land could no longer be considered 'wild'. That means in the time it takes a newborn child to become a teenager, one third of land on earth has been manipulated or industrialised.

The city is the most obvious form of manipulated land where most humans are either already living or are expected to be living in the future, in apartments or houses on streets and highways connected to



this page: instagram account @dailyoverview that posts one aerial image of earth daily

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this page: Uno Port in the Seto Inland Sea, Japan
opposite: Rotterdam Port that connects Europe to the world via the North Sea

workplaces and limitless forms of entertainment. What lies beyond or outside the city becomes more difficult to define when for some time it has been known that less than a quarter of it is untouched wilderness.

“The maps all show the continent to be green wild landscapes save for the sepia cities huddled on lakes and seaboards, but look from a plane as it crosses the continent and makes an idiocy of distances, see the wild

green sectioned as rigorously as the city. In the great plains nature persists only in the meandering stream and the flood plain forest, a meaningful geometry in the Mondrian patterns of unknowing men” - Ian Mcharg, Design with Nature³⁴

This research rejects the idea that a city is the land contained within the border indicated on a map and instead remaps the city as the network of places from which it feeds itself with energy, food, technology and materials and releases itself of emissions, waste and resources. These elements of the city are not fixed geographically but in a constant flux, some more fluid than others. Adrian Lahoud³⁵ has been comparing the paths of travelling aerosol particles, each one identifiable by its unique chemical structure, as a form of climate crime. “The southward trajectory of aerosols and their effect on the climate and the northward trajectory of migrants attempting to flee sub-Saharan Africa and enter Europe aligns in a pernicious geometry.” Invisible paths of particles make their way from cities in developed areas to landscapes in developing areas, where an average ceiling surface temperature is unequally distributed.

The city has now become even more imperceptible, like an octopus with tentacles in far reaching environments beyond the periphery, but at least the fictional dichotomy between urban and rural has been severed. The farm and the mine and the fracking infrastructure out at sea are extensions of the city because those tools have been installed to feed human lifestyle more than to enrich their local environments. Biodiversity is greater in the urban areas where people reside than in regional areas dominated by agriculture and it is steadily increasing in the former while decreasing in the latter.

“Cities have become islands of diversity, surrounded by a more monotonous agricultural landscape. This is a surprising concept for people who think that only nature outside cities is valuable and of rich biodiversity. The structure of Cities, with alternating high and low greens and rock formations in the form of buildings, creates a diversity of microclimates that facilitates a corresponding diversity of flora and fauna.”³⁶

The point of pausing on the macroscopic scale is to dissolve the two-dimensional graphic city border and make way for an image of the inhabited earth as a three-dimensional patchwork mesh of both ecological and artificial networks that is diverse in moments and monocultural at others. The densest moment in the mesh are cities, for their surface area is multiplied across three-dimensional high-rise buildings and infrastructure whereas the mesh is stretched thin in industrial and agricultural patches. A pull from one point in the mesh is consequential to the entire elasticity of the fabric and millions of species are under threat from the imbalance of growth and erasure because their environments are disappearing to deforestation, desertification and land degradation. Though the city itself might not appear to be the direct culprit of biodiversity loss, the extraction of fossil fuels and raw material as well as the mass-production of agriculture are consumed in Cities where



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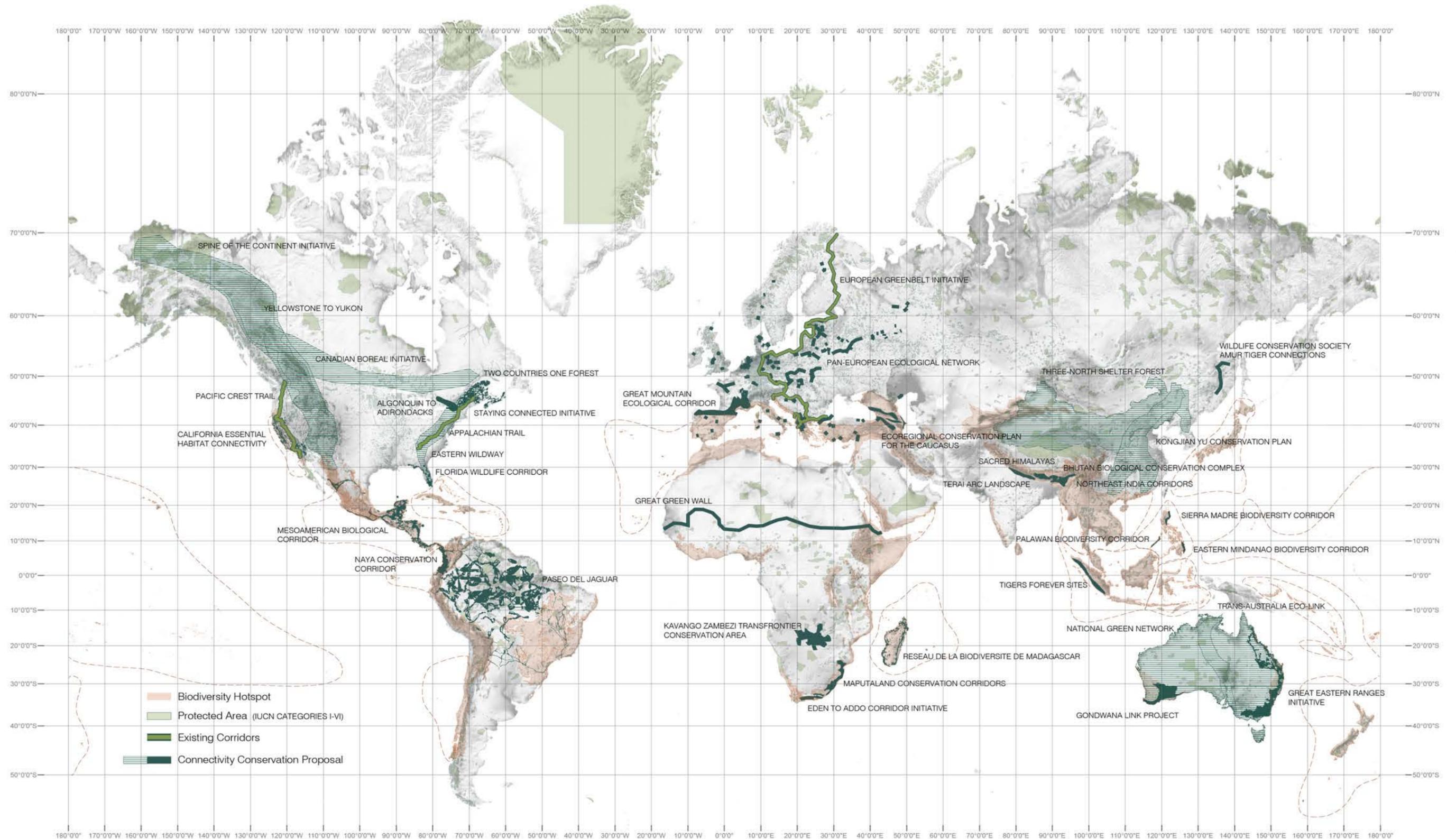
an expanding percentage of the population are opting to live. As the city planning promises of each city reveal, the rising surface temperature of earth and emission levels call for an overhaul of urban energy from fossil fuel sources to renewables. These piecemeal improvements are reliant on complex organisational and funding structures and should be complemented immediately with natural climate solutions that restore ecologies as a means of extracting emissions from the biosphere, as suggested in this open letter³⁷ from scientists;

“By defending, restoring and re-establishing forests, peatlands, mangroves, salt marshes, natural seabeds and other crucial ecosystems, very large amounts of carbon can be removed from the air and stored. At the same time, the protection and restoration of these ecosystems can help to minimise a sixth great extinction, while enhancing local people’s resilience against climate disaster. Defending the living world and defending the climate are, in many cases, one and the same.”

This research focusses on eight of the dense urban nodes of the mesh and enquires what role architecture and its direct collaborations can play in localising systems of plant production and of waste management through ecological principles. When the climate change hyper-object is compartmentalised into planning strategies that promise to improve the resilience of the mesh of varying diversity, what role will architecture and its projects play? This is not a step-by-step guide for how to add plants to your buildings nor is it an attempt to undermine the practice of landscape architecture or the science of ecology by suggesting their expertise belong within architecture but to illustrate the emergence and necessity of urban ecology as a transdisciplinary initiative.

this page: 'global landscape connectivity projects' map showing proposed and partially constructed large scale landscape projects that seek to restore, rewild and reconnect fragmented ecosystems. The map was produced as part of the online project 'Atlas for the End of the World', four and a half centuries after Ortelius' first atlas of the world 'Theatrum Orbis Terrarum' (Theatre of the World) and refers not to an apocalyptic end but to the end of the world where humans consider 'nature' an infinite resource to be exploited without consequence. The atlas was created by landscape architect Richard Weller and others for those curious about where biodiversity is under threat and as a call to action for landscape architects, urban planners and designers to contribute to conservation efforts.

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1.0 London

1.1 Kew Gardens

1.2 Barbican Estate



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In 1821 Queen Elizabeth enforced a 'cordon sanitaire' around London that prohibiting housing development on any sites with no existing buildings and protected a peripheral perimeter intended to remain permanently open. Self-contained communities surrounded by a greenbelt is the fundamental concept of Garden City Urban Planning, first explored by Ebenezer Howard in the 1898 publication **'To-morrow: A Peaceful Path to Real Reform'**³⁸, later reissued as 'Garden Cities of To-morrow' in 1902.

The 1919 Development Plan of Greater London reinforced the prevention of urban sprawl beyond which new development could occur although the Interwar Britain housing boom between 1921 and 1939 brought about dense development on the peripheral ring. The Green Belt Act of 1938 legislated a reserve supply of public open spaces by allowing Local Authorities to buy and retain open land as well as a provision that allowed private landowners compensation for their land to conjoin with the Green Belt. By 1955 a belt of undeveloped open space had amassed around London that extended from eleven to over fifty kilometres in various peripheries.

Today the total area of the London Green Belt is three times that of inner London, one fifth of greater London and accounts for four percent of England's total land area. The peripheral buffer inspires efficient use of previously developed urban brownfield sites within it. As outlined in the National Planning Policy Framework of 2010, five essential characteristics of the Green Belt policy are; managing unrestricted sprawl, preventing neighbouring towns merging, safeguarding countryside from encroachment, preserve setting and identity of historic towns and assist in urban regeneration by preferencing recycling development on derelict brownfield urban land over greenfield sites.

The current Mayor of London, Sadiq Khan, endorses the ongoing protection of the Green Belt as a means of combating urban heat island effect, food production and space for recreation.



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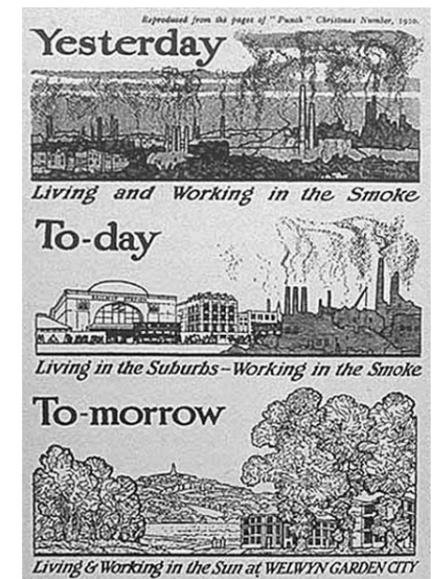


The London Plan³⁹ published for draft in 2017 projects the population of the City to increase by seventy thousand people each year and reach almost eleven million by 2040, meaning over sixty thousand new homes and jobs need to be created every year. The Plan identifies a need to increase work in the green skills sector, a strategy further elaborated in the 2009 **Skills to Grow**⁴⁰ report through seven priorities; increase awareness of sector opportunities, improve entry routes and career paths, improve availability and quality of training, improve management and leadership skills, increase investment in green skills, build capacity for coworking and develop a strong evidence base.



The All London Green Grid⁴¹ published in 2012 set out to improve access to the green belt and connect urban green infrastructure on the ground level as a spreading network, enhancing what exists and extending where a lack is present. It intended to enhance biodiversity and ecological resilience, promote recreation and amenity, provide networks for walking and cycling, reduce flood risk, cool the urban environment and improve air quality.

Three overarching ambitions of the ALGG are; 1. protect, conserve and enhance network of open natural and cultural spaces, 2. encourage greater use of and engagement with green infrastructure, fostering appreciation of natural and cultural landscapes by promoting a sense of place and ownership and 3. secure a network of high quality, well designed and multifunctional urban infrastructure to address challenges of the twenty first century, climate change being the priority.



The Plan defines eleven Green Grid areas (GGAs) that scale down the concept of green infrastructure from recreation and aesthetic toward encouraging local business organisations, neighbourhood communities and voluntary groups to deliver fine-grain projects that cumulatively benefit and impact the overall living fabric of the City.

Twenty percent of London's population, 1.75 million people, were found to be deficient in access to public open space, a measure defined by the distance threshold that any individual should be no more than one kilometre from an open landscape.

To increase access to public space, open spaces were categorised from large to small scale as; Regional, metropolitan, district, local parks and open spaces, small open spaces such as backyards, pocket parks and linear open spaces. Recommendations of the All London Green Grid include; local policy commitment to deliver the Grid within local plans and open spaces, audits of green infrastructure in London boroughs to establish baselines, improving links and corridors between boroughs through site visits and learning trails, encourage new partnerships of the Local Authorities with local businesses, housing associations and developers.

London's Natural Signatures⁴², published in 2011, further aims to restore a balance by which natural context is considered as crucial as built context to the



this page (top): Welwyn Garden City advertisement for sale of homes 1920
this page (bottom): new plantings at the Coal Drops Yard development, Kings Cross, London 2019
opposite (top): the scale of green spaces categorised for the entire city in the All London Green Grid 2012
opposite (bottom): lady strolling through shared park in Peckham

1.1 Kew Gardens

30 future of London. It categorises the City in twenty-two areas that each have signature natural conditions of geology, soil, relationship to watercourse as well as flora and fauna. King George II's mother, Princess August, founded a nine-acre botanic garden within the pleasure grounds of Kew in 1759 which has been blooming ever since. The site's influence on horticulture, plant classification and economic botany spread internationally during Joseph Banks' directorship in the 1770s. Over time, Kew has amassed a vast collection of living, archived and illustrated plants as well as highly skilled landscapers, caretakers, botanists, ecologists and horticulturalists.

In 1913 the suffragettes⁴³ Olive Wharry and Lilian Lenton set the Kew Gardens Tea Houses on fire during a series of arson attacks in London and both were sentenced to 18 months prison where they immediately went on hunger strike until their release. The Representation of the People Act passed in February 1918, enabling women over aged thirty to vote. In 1906 the daily mail named 'Suffragettes' what had until then had been quite a peaceful protest movement that escalated to more violent methods to exercise its cause. The women targeted high-profile public sites to draw awareness to the feminist cause. Their methods included arson, damaging property and chaining



themselves to railings. The Tea Garden attack happened after an earlier unsuccessful attempt to burn the Orchid Houses, amass with valuable species.

What happens at Kew?

Dedicated to the preservation of global plant diversity, the Royal Botanic Gardens of Kew is a sprawling wonderland where each year more than a million visitors come to explore over twenty-seven thousand living plants scattered throughout forty-four structures and landscapes. Kew gained UNESCO cultural world heritage protection in 2003 for its historic and contemporary contributions to advances in the scientific disciplines of botany, ecology and horticulture. The site falls in London's Natural Signature zone number thirteen, Upper Thames, which hosts the meandering River Thames together with transitional mud flats, shingle beaches islands and flood meadows alongside.

The most marvellous indoor collections of plants are housed in the engineered atmospheres of the Davies Alpine House, the Princess of Wales Conservatory, the Palm House and the Temperate House. The latter two were both designed by English architect Decimus Burton in the nineteenth century and serve as time capsules of innovation in modern glass and iron construction. Born in 1800, Burton in his thirties was commissioned to design a curvilinear glasshouse for the gardener Joseph Paxton who would later bring the Crystal Palace to life. As the architect for the Royal Zoological Society, the Royal Botanic Society and the Royal Botanic Gardens at Kew, Burton developed a rich portfolio of horticultural detailing. The curvature of the Palm House at Kew is evidence of a strong collaboration between his experience and the construction of Richard Turner, a third-generation ironsmith and glasshouse designer from Dublin.

The Temperate House in contrast is more ambitious in its scale, geometry and complex construction which spanned forty years from 1859 and outlasted two



this page (top): information panels detailing species throughout Kew Gardens
 this page (bottom): Palm House by Decimus Burton, opened in 1840
 opposite (top): historical images of groundstaff at Kew scanned from archive
 opposite (bottom): Princess of Wales Conservatory

Kew directors and the architect himself. After a 2010 government condition report concluded that "urgent restoration is essential if closure is to be avoided", Donald Inshall and Associates managed a delicate seventy-three million AUD heritage restoration⁴⁴ of the Temperate House. Over five years with over four hundred people on hand, sixty-nine thousand original elements were removed for repair, fifteen thousand panes of glass were replaced, over five thousand litres of paint applied and ten thousand species replanted.

Urban ecology at Kew

Architectural space dedicated to both the preservation of rare ecosystems and the scientific research and practice that enables them to be engineered in constructed environments are the reason for Kew's selection in this study. The Herbarium opened in 1841 and with over seven million species is the global centre for the naming and classification of the world's plants. Many of its collection has become digitised as the Kew Herbarium Catalogue⁴⁵ and is publicly available online.

Each year in the Herbarium, newly discovered species are described, over four hundred scientists visit the facility and around ten thousand species are loaned out for research purposes. Four questions driving the Herbarium are; What plants and fungi occur on earth and how is diversity distributed? What drivers underpin





global plant and fungal diversity? What diversity is under threat and requires conservation in resilience to global change? Which species contribute to important ecosystem services and natural capital and how can they be managed?

Horticulture's etymology derives from the latin hortus (garden) combined with cultus (cultivation) and encompasses a finer scale of cultivation than agriculture by planting a diverse range of crops on small plots rather than large fields of single crops, or plantations. The small-scale approach to species diversity evidenced in the origins of Horticulture is important in our current moment as a response to the parallel crises of climate breakdown and ecological collapse.

In the open letter to the world⁴⁶, scientists and activists made a case for Natural Climate Solutions as an underfunded and over-political yet entirely practical solution to



provide one third of the greenhouse gas mitigation required before 2030. Among the questions explored through Natural Solutions is how to sequester seven-hundred and thirty billion tonnes of CO₂, the amount required to keep earth's surface temperature below 1.5°C and is equivalent to that emitted by the USA, UK, Germany and

China combined since the industrial revolution.

Research by Lewis, Wheeler and colleagues⁴⁷ has shown that efforts in reforestation such as the Bonn challenge⁴⁸, which aimed to restore one hundred and fifty million hectares of degraded land by 2020, overlooked the inability for plantations of single species on large plots

to store carbon. That which is stored is released back into the atmosphere at the event of the tree's death for commercial purpose whereas natural forests of ecological diversity continue to sequester carbon for decades.

Kew: A living structure

Between Kew Royal Botanic Gardens and the Millenium Seedbank offsite at Wakehurst, the collection contains 50,000 DNA samples, 35,000 species in DNA bank, 7m herbarium sheets, 1.25m dried fungal species, 180,000 individual plants of over 30,000 taxa including 1,300 threatened species as well as 2 billion seeds from 36,000 species through partnerships with 80 countries.

Wakehurst is one of many international seed storage facilities and our local response is the Australian Plant bank in Mount Annan, New South Wales. The most astounding is the Norwegian Svalbard Doomsday seed vault buried deep beneath permafrost on the island of Spitsbergen in a remote Archipelago near the North Pole. The facility stores duplicate samples of seeds stored in gene banks worldwide to be extracted in the event of global crises. The documentary film 'Wild Relatives'⁴⁹ follows the journey of the first extraction from the Svalbard facility to recover a collection left behind by a Syrian institution forced to relocate to Lebanon due to the civil war.

The Palm House is an internalised rainforest amass with vegetation and its air heavy. Rainforest plants cover two percent of the earth's surface but make up fifty percent of the world's known species. The species housed at Kew include the Rubber tree (*Hevea brasiliensis*), African oil palm (*Elaeis guineensis*), or cocoa tree (*Theobroma cacao*), Madagascar periwinkle (*Catharanthus roseus*), now used in the treatment of a number of different types of cancer, Madagascar palm, *Tahina spectabilis* which lives for about 50 years, flowers once, and dies soon after, The once-lost café marron (*Ramosmania rodriguesii*), the world's oldest potted plant brought from South Africa to England in 1775 is a prickly cycad (*Encaphalartos altensteinii*)

The Temperate House is home to a thousand and fifty different species from temperate zones of the world in Africa, Australia, New Zealand, the Americas, Asia and the Pacific Islands. These species require conditions above 10 degrees celcius to survive and many are under threat. Plants in the Temperate House include the Kaka beak (*Clianthus maximus*) an endemic New Zealand species named after the endangered Kaka parrot, the Tree pincushion (*Leucospermum conocarpodendron*) endemic to South Africa and grown in London from seed collected in 1803 and germinated by Kew scientists and the Chilean wine palm (*Jubaea chilensis*), a Chilean native whose sap is used for palm wine and can only be extracted from felling the tree.



this page (top): maintenance and visitors to the newly renovated Temperate House
this page (bottom): Kew Herbarium interiors, Kew
opposite (both): interior details of the restored Temperate House, Kew



1.2 Barbican Estate

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The word Barbican derives from the low latin **Barbecana** for a fortified outpost or tower over a gate or bridge acting in defence. In the case of London, a Roman specula or watchtower once stood on the former site of what is now the Barbican Estate in Cripplegate. It formed part of the City walls built in 200 AD that incorporated the fort of Roman London erected between 90 and 120 AD. On 29 December 1940 London was devastatingly bombed under German fire and aside from the Church of St Giles Cripplegate, the entire site on which the Barbican Estate stands was flattened.

The Town and Country Planning Act of 1947 enabled local authorities to buy and redevelop large parcels of land, as was the case with the Corporation of the City of London and the Barbican. From the selection of Chamberlin, Powell and Bon as design architects in 1959 through to the official opening of the mixed-use residential, education and arts estate in 1982, the site was under development for twenty-three years.

Nearly one thousand laborers were working on the Barbican in May 1976 there was an all-out two-week strike for refusal of management to remove asbestos. Prior to the residential development becoming the favoured plan, a proposal was offered to excavate the entire site eighteen metres and fill it with warehouses and factories. Barbican flats were originally intended to meet demand among middle- and high-income earners in the City to relieve rush hour public transport congestion. The buildings of the Estate were awarded Grade II listing in 2001, a reflection of a renewed appreciation for brutalist construction and its preservation. Sale of apartments in the Barbican in 2019 were advertised at AUD \$893,000 for a one bedroom and AUD \$7,000,000.00 for a renovated five bedroom.

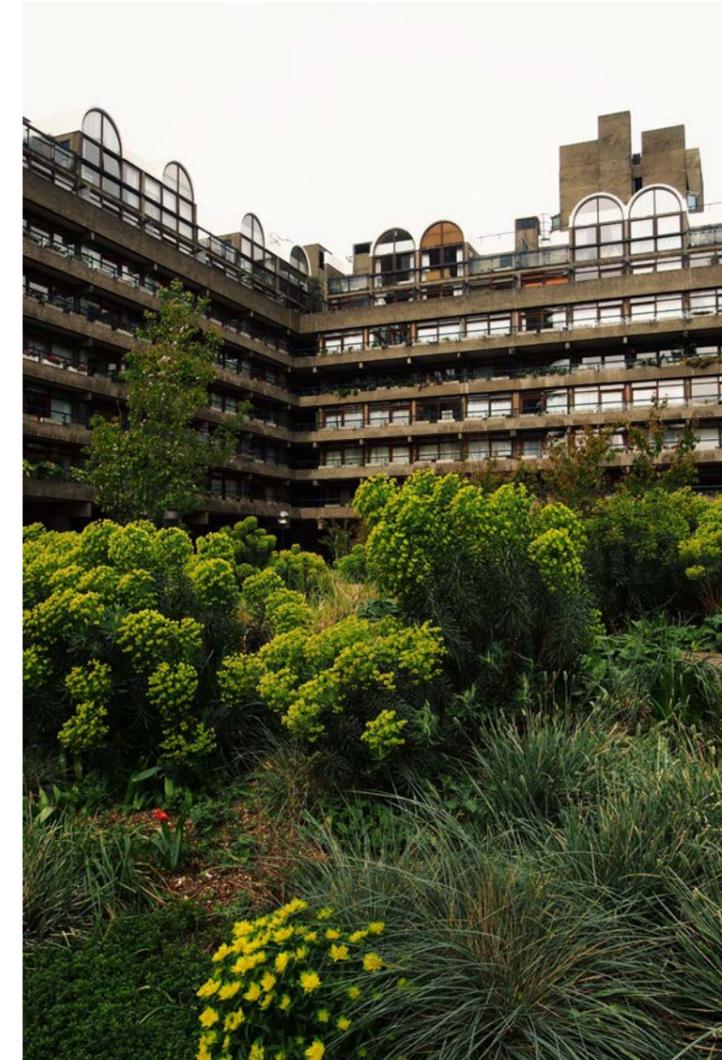
What happens at the Barbican?

Barbican Estate houses four thousand residents in over two thousand apartments spread throughout three towers and thirteen terrace blocks as well as two schools. The Barbican Arts Centre, Europe's largest cultural and arts centre, comprises; Silk street theatre, cinemas, an art gallery, library, Milton court concert hall, guildhall school of music & drama, the pit studio theatre and a conservatory. The Hammersmith, Metropolitan and City Lines run eighteen metres beneath the Barbican Centre and an additional tunnel has been carved 30m below the site for the recently constructed Crossrail.

Partially modelled off Venice where people walk on pavements and bridges that cross traffic routes, the site separates traffic and pedestrians by directing the former off perimeter roads to underground parking and constructing elevated podia, bridges and platforms that support and provide access to the buildings, lake and constructed landscapes for humans. The floor of the podium comprises structural discontinuities through various slabs of 14m² separated by waterproof expansion joints.

Large concrete columns run vertically from the basement parking slab through to the podium ceilings, spaced ten meters apart for traffic function. They were cast in sections, stacked and bush-hammered to conceal layering. The terraces and towers take on a cross-wall construction system. Interior and core structural walls are supplemented with 1.8m lateral concrete beams along the facades of blocks at every level.

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this page (top) & opposite: aquatic and planted landscapes within the Barbican Estate 2019
this page (bottom): City of London brochure for the letting of flats in Barbican





Urban ecology at the Barbican

Over ninety thousand square metres of the project comprises open space, over half of which is dedicated to public footways and the large remainder to landscapes and aquatic environments. In 2004, the lakes were upgraded to include islands of natural reeds as refugia for local wildlife. In 2012, an opportunity to reimagine the podium landscapes in the context of climate change arose from the need to reline the gardens to prevent water penetration to the properties below and through the desire by the City of London Corporation to reduce or eliminate

reliance on automatic irrigation with potable water to those areas. This process invited a reconsideration of the planting scheme, up to which point had comprised grass, flower beds, trees and shrubs that required continual irrigation and intense maintenance.

Working on the Beech Gardens and podium plantings⁵⁰ in 2015, Plantsman and designer Nigel Dunnett introduced the concept of a steppe meadow which require minimal irrigation but produce seasonal visual interest and welcome pollinating insects. Alongside his own practice, Nigel is the director of Sheffield University's Green Roof Centre and professor of planting design and vegetation technology.

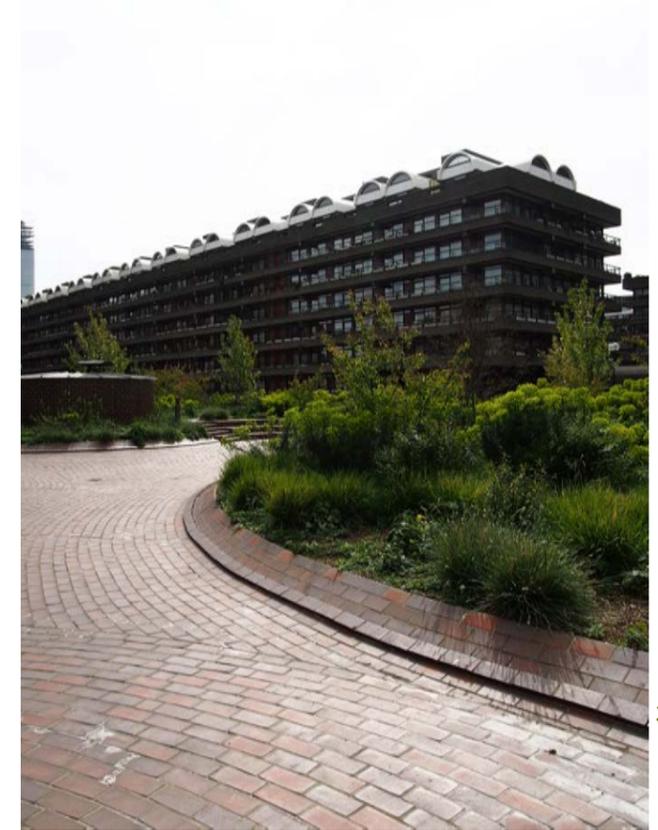
He has spent over fifteen years researching and developing innovative green infrastructure for high density urban development that incorporates inspiring planting that is at the same time affordable and ecologically beneficial. The research is injected in real projects - landscapes above structures - which in themselves become objects of research. Podium landscapes created above structures as evident in the Barbican could become a component of virtually all urban development.

Barbican: a living Structure

Humans are but one species occupying the Barbican throughout the seasons, and one anonymous resident who has called the project home for over thirty years has taken interest in documenting everything one could possibly enquire of its history and detail on the public website Barbican Living⁵¹. Residents also have a community print magazine delivered quarterly.

Dunnett's planting scheme design consists of three communities of plants that are ecologically compatible and suited to different microclimates around the site according to how much such those areas receive. Steppe Plantings have been introduced in areas with full sun. Diverse in colour, form and texture, this pant community hosts grasses and perennials naturally adapted to dry and exposed conditions. Shrub Steppe Plantings combine elements of the first community with low-density shrubs and multi stemmed trees to create layered plantings with year-round structure. Finally, Light Woodland Plantings occur in part shade with deeper growing medium for tree root systems. Widely spaced multi stem trees create a light and open canopy with a rambling understory of perennials and shrubs.

Peregrine Falcons are the fastest member of the animal kingdom, travelling at speeds over 322 kilometres per hour during a characteristic hunting stoop. The species population suffered from pesticides before DDT was banned though have adapted to living and breeding in urban environments as in one of the Barbican towers. Found in the site's wetlands are waterbird species of Mallards, ruddy ducks, Egyptian geese, American Wood Duck, Seagulls, Moorhens, Coots, Heron and Canada Geese. Carp were introduced in the lake to control middens storming concert attendees and were counted at 3,500 when the lake was drained for maintenance and 1000 Golden Orfe and Golden Rudd were introduced.



this page (top) & opposite: aquatic and planted landscapes within the Barbican Estate 2019
this page (bottom): City of London brochure for the letting of flats in Barbican

2.0 New York City

2.1 Oystertecture

2.2 The High Line



38 New York City's development is a tale of how emerging urban architecture instigates valuable relationships with the often invisible or undervalued species that have create habitats among citizens. Many of the world's Cities are formed around a prominent body of water that provided traffic of trade, aquatic food sources and an overall essential element of life in recreation and openness. In 2015 the Mayor's office published 'One New York: The Plan for a Strong and Just City'⁵² to put in practice urgent changes necessary to mitigate climate change and inequality at intermediate milestones until 2050 through four visions; growing and thriving, just and equitable, sustainable and resilient. Those visions were further compartmentalised into nine volumes including an introduction and eight detailed propositions for; a vibrant democracy, an inclusive economy, thriving neighbourhoods, healthy lives, equity and excellence in education, a liveable climate, efficient mobility and modern infrastructure.



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In OneNYC 2050: New York's Strategic Plan⁵³, New York places itself as a global, multicultural and progressive City from which others should expect leadership in the context of an international rise in nationalism, intolerance and authoritarianism that contributes to political apathy. It admits governing bodies are failing to take action to protect the climate and earth's assets as we secure basic human rights. The document establishes itself as a paradigm of the progressive migrant metropolis. Despite a lower rate of population change over the past twenty years compared to other major urban regions such as Lagos, New York are responsible for triple the annual carbon dioxide emission rate per capita than the Nigerian region. This comparison reveals an imbalance in the effect of production and consumption rates in regions of differing gross domestic product between the global north and south.

With America's wavering commitment to respond to climate change as an issue transcending national and international borders, when Washington pulled out of the Paris Climate Agreement, New York sought to provide an exemplar sustainable plan to encourage other states and ultimately forge a national plan.

Of almost fifteen thousand New Yorkers who responded to a public opinion survey on the City's challenges, only nineteen percent selected climate change and seventeen percent the environment. The initiatives entwined in progressive urban ecology that are essential to this study are partially introduced in OneNYC 2050 then expanded on in A Liveable Climate⁵⁴. A progress report published in 2018 confirmed that after three years all OneNYC initiatives were underway and eighty percent of the indicators are stable or improving.

Planning promises

The City of New York proposed to measure the liveability of its climate through four indicators that have been formulated with the United Nations Sustainable Development Goals in mind;

1. eliminating, reducing or offsetting greenhouse gas emissions to 100% by 2050. A carbon neutral City generates net-zero greenhouse gas emissions in all sectors it reports on including; buildings, energy, transportation and waste. Buildings account for over two thirds of New York City's greenhouse gas emissions followed by transportation and waste. Carbon credits, one of which represents one metric tonne of CO2 removed from the atmosphere, can be gained by projects outside the City's emissions inventory boundary. This could be planting a forest or planting a rooftop garden but must follow strict environmental integrity. Since 2005 as a baseline, emissions had reduced by seventeen percent in 2017, with a thirty percent reduction in municipal emissions.

2. share of electricity from 100% clean sources by 2040 (27% 2019). This goal is of particular interest to the architecture community, as

the city transitions from best-practice to requiring all buildings designed from 2030 to be net-zero, generating all energy required for operation from solar, wind, water and passive systems.

Cleaning the energy grid to renewable sources will improve air quality in the City and support the electrification of building systems and the resilience of energy supply. The City's energy today is generated by natural gas, hydropower, wind and solar resources from upstate regions that reach the city by high-voltage transmission power lines and a distribution grid of an under and overground privately owned cabling system to the end user. Almost half a million New York homes are over the targeted energy spend.

The City has committed to increase the health and resilience of green and natural infrastructure that provide vital services through stormwater management, coastal protection and heat mitigation as well as provide spaces that offer opportunities for education, engagement and stewardship, and foster community interactions and togetherness

3. Flood insurance enrolments are to increase from 35,494 in 2019. Over a million people residing in the expanded coastal floodplain will be vulnerable to flooding, with sea levels expected to rise above seventy-five centimetres. High tides will cause flooding twice daily in some areas and permanent inundation in others. Without protective measure, Coney Island, Rockaway Peninsula, Flushing Meadows, East Harlem and the East shore of Staten Island could flood during storms. The City is investing five hundred million dollars in flood-risk-mitigation projects that cover seventy percent of the Lower Manhattan shoreline.

4. City pension fund investments in climate change solutions - Increase to \$4B by 2021 (\$2B in 2019). The City are pursuing a lawsuit filed against five investor-owned fossil fuel companies that contributed most to climate change, which a federal judge dismissed in July 2018. Funds from the City's pension are being diverted from all fossil fuel reserve owners while advocacy for regulation of greenhouse gasses is being funded.



this page (top): Ford Foundation building's verdant open lobby garden, built in 1967 and revitalised in 2018

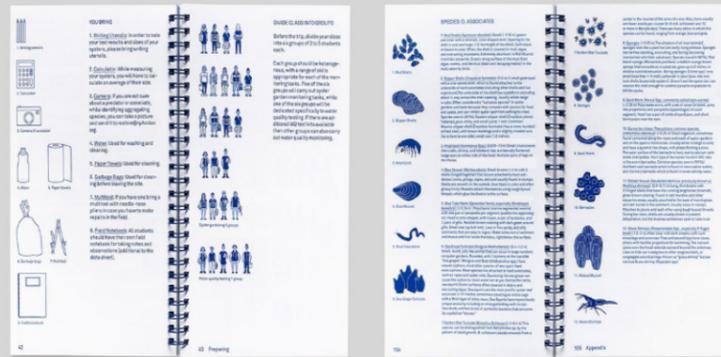
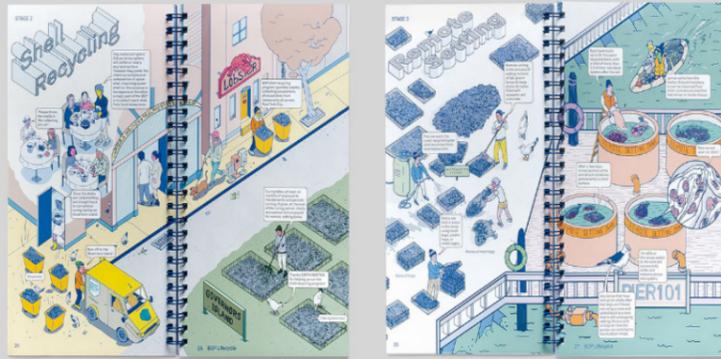
this page: Trisha Donnelly's installation of ancient trees (Leontyne Price's carmen plays in the background)

opposite: Kingsland Wild-flowers rooftop



2.1 Oystertecture

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New York City lies where the North Atlantic Ocean meets the mouth of the Hudson Canal, whose water travels south east almost five hundred kilometres from Lake Tear of the Clouds in the Adirondack mountains via the picturesque Palisades. The City is built upon water and through trade the water has built the City it is today.

Remains of over eight thousand encampments have been discovered throughout New York City from the Indigenous Lenape Delaware people whose dialects stretched across the North-eastern Woodlands of Canada and the United States. For an estimated three thousand years before colonisation, the Lenape cultivated fields of vegetation with the slash and burn technique and harvested fish and shellfish such as oysters and clams from the City's bays. The Colonial claiming and renaming of the area evolved from New Angouleme by the Italian explorer Giovanni da Verrazano in 1524, New Amsterdam by the Dutch in 1624 and finally New York by the English in 1664.

three thousand years before colonisation, the Lenape cultivated fields of vegetation with the slash and burn technique and harvested fish and shellfish such as oysters and clams from the City's bays. The Colonial claiming and renaming of the area evolved from New Angouleme by the Italian explorer Giovanni da Verrazano in 1524, New Amsterdam by the Dutch in 1624 and finally New York by the English in 1664.



“The Hudson and its shores were shaped to accommodate steamboats. Wharves and piers extended into the river, soft-edged shorelines were hardened and contained. River edges were diked, and the bottom dredged. The resulting deeper, straighter Hudson worked well for shipping, But the shallows that once supported plants and animals, filtered the water and protected against flooding largely disappeared.” Hudson Rising exhibition⁵⁵

this page (both): Harbor school units filled with discarded oyster shells deployed in Hudson River
opposite (top): Oyster Gardening Manual by illustrator Boyeon Choi in collaboration with Harbor School and SCAPE studio.
opposite (bottom): volunteers for the Billion Oyster Project at work



In 1880 a hundred and thirty-five ice houses lined the Hudson between New York and Albany, providing twenty thousand jobs and producing two million tonnes of ice. Horse-drawn ice plows and workers with hand tools cut the ice into large blocks to be shipped to the city to maintain freshness, a practice that lasted until the early 1920s when artificial refrigeration was introduced.

Bricks, iron, coal, tanneries and even landscape painting all have rich histories of production along the Hudson River, but it is the marvellous oyster this project wishes to highlight. New York lost its oyster population first to overharvesting at the onset of the seventeenth century and next to pollution in the first quarter of the twentieth. As oysters feed by filtering the water surrounding them, people ingest that which the bivalve mollusc consumes. Sewage-infested waters spread typhoid throughout New York in the late 1800s and in 1927 the last of the Raritan Bay oyster beds ended business, ending commercial oystering in the Hudson estuary.

What is Oystertecture?

Oystertecture was a proposal formulated by SCAPE landscape architecture⁵⁶ during a residency at MOMA New York between November 2009 and January 2010. The Rising Currents⁵⁷ exhibition aimed to reimagine the City's coastlines with soft infrastructures that are sympathetic to ecology and ignite dialogue among policy makers and the public on the urgency of rising sea levels due to climate change by presenting proposals by interdisciplinary creative teams. SCAPE proposed a community-based reef building project in the Gowanus Bay that would simultaneously slow waves and filter water, generating a productive and active waterfront for New Yorkers that sets in motion ongoing human engagement with a clean Harbour. Oystertecture is a design proposal that multiplies existing social and ecological initiatives already in place

across the City. New York Harbor School⁵⁸ is a public high school on Governor's Island that offers a curriculum actively integrated with its aquatic surroundings and species. In the ten years since Harbor School initiated the Billion Oyster Project⁵⁹, almost thirty million oysters have been planted in New York Harbor, a million pounds of shells recycled, seventy five restaurants contribute shell waste and over nine thousand volunteers and eight thousand students from seventy schools are actively involved in fabricating oyster reefs and diving to place them.

In opposition of the scaling down inherent in massive infrastructural gestures like dredging, dumping, walling and infilling, Oystertecture collaborated with Harbor School to scale up an existing system to an interdisciplinary design proposition for the future. It lays focus on behaviour and active citizen engagement informing an infrastructure on which oysters and mussels and the creatures they attract can thrive in an urban ecology.



The interactive ethos of SCAPE is also evident in their successful proposal for the Living Breakwaters competition to reduce risk, revive ecologies and inspire a more resilient region in the future where harbor stewards are actively involved. The breakwaters visually and physically dissolve the disconnection between people and the water normally established by conventional coastal infrastructures like levee walls. The breakwaters are instead a system of fragmented, engineered ecosystems formed from sediment, stone and e-concrete units which gain strength from the limestone produced by the growing oysters they contain. Collectively, they mitigate storm effects and provided habitat for species such as juvenile fish.



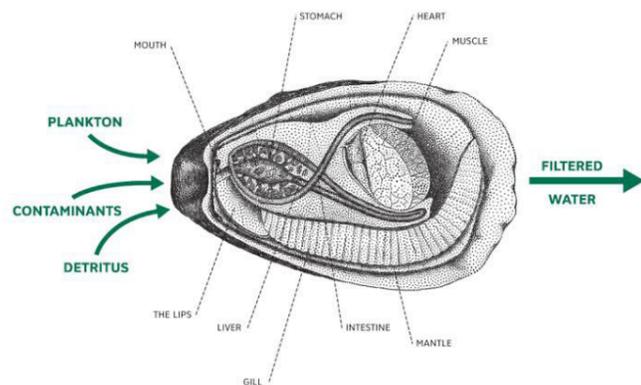
Urban Ecology

“Just as we have cultivated plants for millennia, we must similarly be stewards for fauna in what is now a contiguous, planet-sized, open zoo with no keepers” - Kate Orff⁶⁰

A two-phase process, Oystertecture⁶¹ proposes both the Gowanus Canal as the production site for an aquatic living and working culture and the Palisade Reef as a blue park for New York city diving, recreation and habitat restoration. Oyster spats or larvae are raised in floating upwelling system nursery rafts (FLUPSY) from discarded shells along the borders of the Gowanus Canal in lower Brooklyn. Nutrient-rich water is filtered by submerged FLUPSY chambers filled with spat and drawn to the wider Gowanus, creating a clean environment to upscale the operation.

The site cultivates water-based transit, aquatic education and new models for living on the water while reserving sites for the Combined Sewer Overflow Gardens to remove contaminants. In the Palisade Reef, youthful oysters are transplanted on a matrix of fuzzy rope and fixed pylons that assemble to form a blue park emerging above the high-water line and inviting recreation and interaction of citizens with the aquatic ecosystems of the City. The oysters mature and aggregate over time to form a subtidal and intertidal reef armature that calms wave energy and over time cleanses the harbour water through the working oyster as an active filter.

Founded in 2005 by Kate Orff, SCAPE is engaged in the practice of urban ecology with an aspiration to capture the transition from a top-down monocultural program for infrastructure and the environment toward a collaborative and communal participation driven methodology that welcomes the uncertainty and emergence of change over time.



this page (top): SCAPE studio diagram for Living Breakwaters project
 this page (bottom): Cooking Sections 'Climavore' installation
 opposite (top): diving volunteer for the Billion Oyster Project
 opposite (bottom): SCAPE studio diagram for Oystertecture project

“A feminist approach builds on descriptions of complex and dynamic relationships that catalyse new connections and affiliations. A feminist framework does not seek to merely replace a patriarchal hierarchy, but rather to replace a dualistic and hierarchical view with a fluidity of bonds and associations and webs. It is a wickedly democratic structure that is always becoming and without the distinctions between art and science. This view is defined as a human construct of relationships in the built environment and the ecological is described as the natural processes and systems and, finally, design is the act of intentionally bringing these elements into engagement with each other.” - Thaisa Way

Oystertecture: A Living Structure

Oysters are aquatic ecosystem engineers. They are filter feeders that can filter up to five litres of water per hour by capturing contaminants, plankton and detritus in the mucus of the gills then transporting it to the mouth where it is eaten, digested and expelled. The oyster is a keystone species because in collective reef formation it provides habitat for other marine species and can multiply the surface area of a flat bottom fifty times. All oysters are born male but most change permanently to female around their first birthday though their reproductive organs produce both sperm and eggs, allowing them to change gender at will. **Merroir** is a term coined by Greg Atkinson in 2003 to denote the flavour profile an oyster takes on from the waters in which

it has grown, as **terroir** reflects the way food and wine grapes bear the taste of their native soil. Over eighty percent of oyster reefs have collapsed globally⁶².

Protecting shelf seas from trawling and dredging could make a significant contribution to carbon sequestration as there is expected to be a considerable, but so far unmeasured, carbon opportunity cost of trawling⁶³. Trawling first destroys, then prevents the re-establishment of, the biotic crusts that once covered much of the seabed on the world's continental shelves. Many of these crusts were composed of filter-feeders such as oysters and other bivalves that extracted carbon from the water column, sequestering it as calcium carbonate and often building substantial reefs. When these were smashed, not only was this storage potential lost, but the underlying sediments became exposed to disturbance and, potentially, enhanced oxidation.

“Mutualism in biology describes a relationship between two species in which both benefit from the association. Designing for mutualism means recognising and fostering the links between environment, organisms and land-use practices and identifying the complex cycles that tie together different species and systems.” - Kate Orff

Cooking Sections is the duo of London based spatial practitioners Daniel Fernandez and Alon Schwabe. In 2015, the pair created an installation on the Isle of Skye in Scotland as a form of enquiry into the affect human-induced climate change would have on seasons of food production and consumption. A submerged oyster farm at high tide, the installation is a human dining table that reveals itself daily at low tide and welcomes guests to taste recipes featuring seaweeds, oysters, clams and mussels.



2.2 the High Line

Before New York's expansion in 1830, the land beneath the High Line was submerged in the Hudson River. Perched nine metres above street level, the western freight way was originally branded in the as the Life Line of New York because it delivered food, milk and meat to Manhattan's west side between 1934 and 1980. As manufacturing businesses left the area throughout the seventies, the industrial area around the high line gave way to open parking lots, the trucking industry displaced freight trains servicing the City and an expanding creative elite reoccupied its empty lofts and warehouses. In the nineteen eighties the first seeds, brought by birds, grew to plants whose death formed the first organic material cycle on the structure. Over the following years nature began to take over; soil-making, plant growth and biodiversification amassed to present a melancholic and benevolent garden.

Demolition of the High Line was ordered in 2001 and rescinded in 2002 when the Trust for Public Space published 'Reclaiming the High Line', recommending the designed preservation of the structure for public use. Joshua David and Robert Hammond had formed Friends of the

High Line⁶⁴ in 1999 to preserve the structure, as residents who saw something no one else could, a continuous ribbon of emergent meadow worth preserving despite knowing how or why. The next year they commissioned photographer Joel Sternfeld for the series Walking the High Line⁶⁵ to capture the abandoned overgrown structure over the course of a year's seasonal shifts. The images demonstrated a powerful silence palpably strange in Manhattan.

Friends of the High Line launched an open international ideas competition for the Site in 2003 which received over seven hundred entries from over thirty countries. The winning design brought together plantsman Piet Oudolf, architects Diller, Scofidio and Renfro, engineering firms Silman Associates for restoration and BuroHappold for redesign under the leadership of James Corner Field Operations. The unprecedented nature of the project posed difficulty regarding which authority would manage the contracts and delivery of the project between the buildings, parks or transportation departments.

What transformed the High Line?

When the High Line was under development, critique of a longstanding preference for native versus introduced species or weeds in landscaping had already burst open thanks to Michael Pollen's essay

Against Nativism⁶⁶ published in the New York Times in 1994. Pollen set out to reveal weaknesses in America's trending natural garden movement, led by designers and ecologists who considered the national garden a

place that; outlaws human artifice in its design, grants exclusive citizenship to native plants over "flora non grata" subject to deportation, guarantees the right of self-determination to all its flora and non-human fauna and resembles the pre-settlement American landscapes of its region. From wetlands fringed with bulrushes to a dappled grove of birch trees rising from a trillium carpet, these beautiful and subtle designs aimed to recreate landscapes as they were in the wild, in an offer of habitat refuge to threatened species. Unconvinced by the ecological science behind the designers' preference, Pollen countered that migration of all human and non-human species is an abiding, and often irreversible event of natural history. Rather than attempting to reverse time to an unknown beginning, he offers to the contemporary gardener the inherited "mongrel" urban ecology as a starting point with which to work.

Drawing parallel between native wild landscapes and anti-immigration discourse, Pollen revisits a group of landscape designers in Germany who in 1939 set out to give the German people its characteristic garden and guard it from unwholesome "alien influences" such as foreign plants and landscape formality. Designed to look like untended German landscapes, those pre-World War Two assemblages of strictly native species caused Pollen, fifty-five years later, to question whether "there is nothing more than scientific concern about invasive species behind the current fashion for natural gardening and native plants in America - not when our national politics are rife with anxieties about immigration and isolationist sentiment."

Urban ecology on the High Line

"The high line has not gone to wrack and ruin but to seed: weeds and grasses and even small trees sprout from the track bed. There are irises and lambs' ears and thistle-tufted onion grass, white flowering bushes and pink budded trees and grape hyacinths, and strange New York weeds that shoot straight up with horizontal arms, as though electrified." Adam Gopnik⁶⁷

Though the Promenade Plantee in Paris became the world's first elevated parkway when a viaduct that had operated between 1859 and 1969 was transformed into a continuous landscape, New York's High Line created a precedent in how the design revealed layers of the City's memory through both infrastructure and landscape. On the coming together of these two found conditions, the design emulated the self-similarity of the railbed landscape, two and a half kilometres of a constant ribbon in memory of motion with vegetation habitats that bulge and pinch and alter their quality according to different microclimates. In an open-ended agenda, the design concept deliberately avoided prescribing the High Line's function by instead asking what will grow here? in a series of diagrams documenting potential; programs, habitats, atmospheres, microclimates, connections,

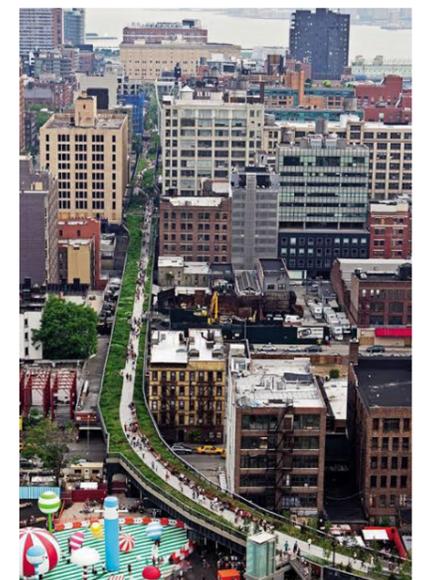


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this page (top): Joel Sternfeld 'walking the high line' photographic series
 this page (bottom): Diller, Scofidio and Renfro aerial image of High Line project
 opposite (top): family relax on high line sun lounges
 opposite (bottom): aerial photograph of high line from unknown source
 overleaf: perspective series of walking the high line



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ecosystems, nocturnal life, economies and communities. Its architect Elizabeth Diller described the inherited site as the evidence of the conquest of nature over culture where culture was returning but doing so in a way where the two entities would coexist. The nature-culture divide is one of theoretical anthropology where wilderness is framed in opposition to planted in or cultivated gardens. Autochthonous life forms are indigenous - inhabitants, species or geological forms - that are not considered to have descended from migrants or colonial invasion.

“The colonial landscape was sustained by, and fed into, an intense traffic in people, plants, animals and germs between the metropolis and plantations, and between plantations in the East and West. Once we see colonialism as the literal planting and displanting of peoples, animals and plants - as inscribing a domination into blood and soil founded in the fantasy of moulding ecosystems with godlike arrogance - it becomes clear how colonialism ushered in the Anthropocene.” - Tomaz Mastnak⁶⁸

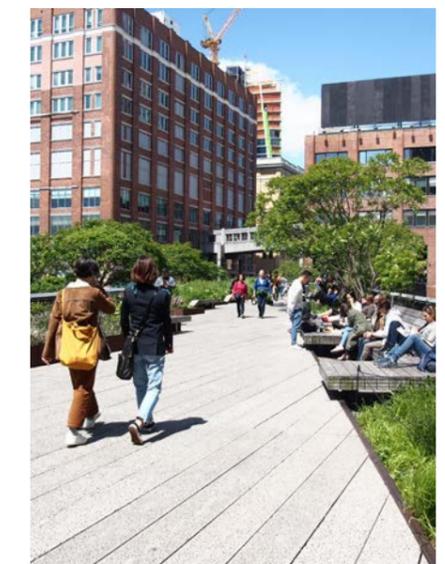
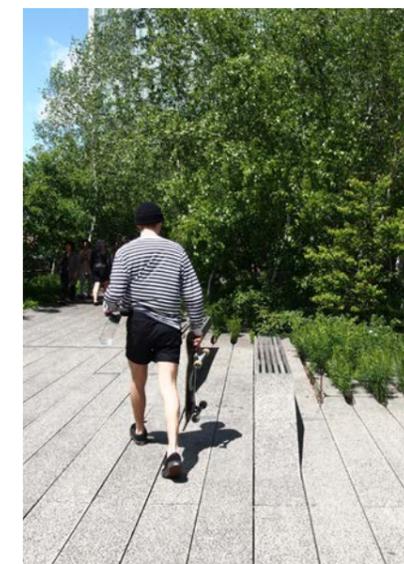
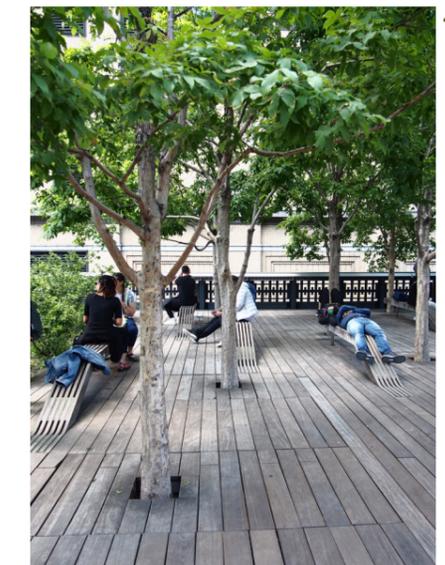
The High Line: a living structure

The planting scheme of the High Line is centred around preserving the wild and opportunistic landscape that emerged in its abandon by enhancing existing plant species to create a rough and informal aura. Of the four hundred species of bulbs, grasses, perennials, shrubs and trees chosen, many are what most people would consider weeds. Upon the realisation that the most powerful act of the design was to leave the High Line almost alone, many of the theatrical features embedded in the competition phase were eliminated in order to, as James Corner puts it “do all we could to maintain everything that made the High Line distinct from other spaces in the city: its melancholy and other worldliness; its autonomy and wildness; and its sense of pace and duration”. The project was intended for slow meandering of people on foot.

Of all the projects visited and documented on this research expedition, the High Line raised an unexpected but interesting discussion about particular preferences humans have for the plant categories in their place from; native to naturalised to exotic and invasive.

Ruderal Society is a term used to explain the growth of plants on waste ground countering the anthropocentric ideal of “primary nature”, acting against the aesthetics of the pure and true against ordering forces. Wild vegetation that flourish on post-industrial sites and at the urban periphery are materially speaking untamed and more nature than society’s carefully controlled zones of contemporary “wilderness”.

Ruderals are the ever-present underclass of the plant world, the “multitude” ready to break through the city’s surface at any opportunity, cracking the veneer of order and stability. The term was coined by the Austrian artist Lois Weinberger⁶⁹ who, born in 1947, has spent his life designing situations for botanic insurgents to enact their cycle of growth and decay, regardless of human society where the living reveals itself above the orderly in a continual process of transformation.



3.0 Berlin

3.1 Floating University

3.2 Prinzessinengarten

2013 The Berlin Strategy
urban Development Concept
2015 The Berlin Strategy 2030

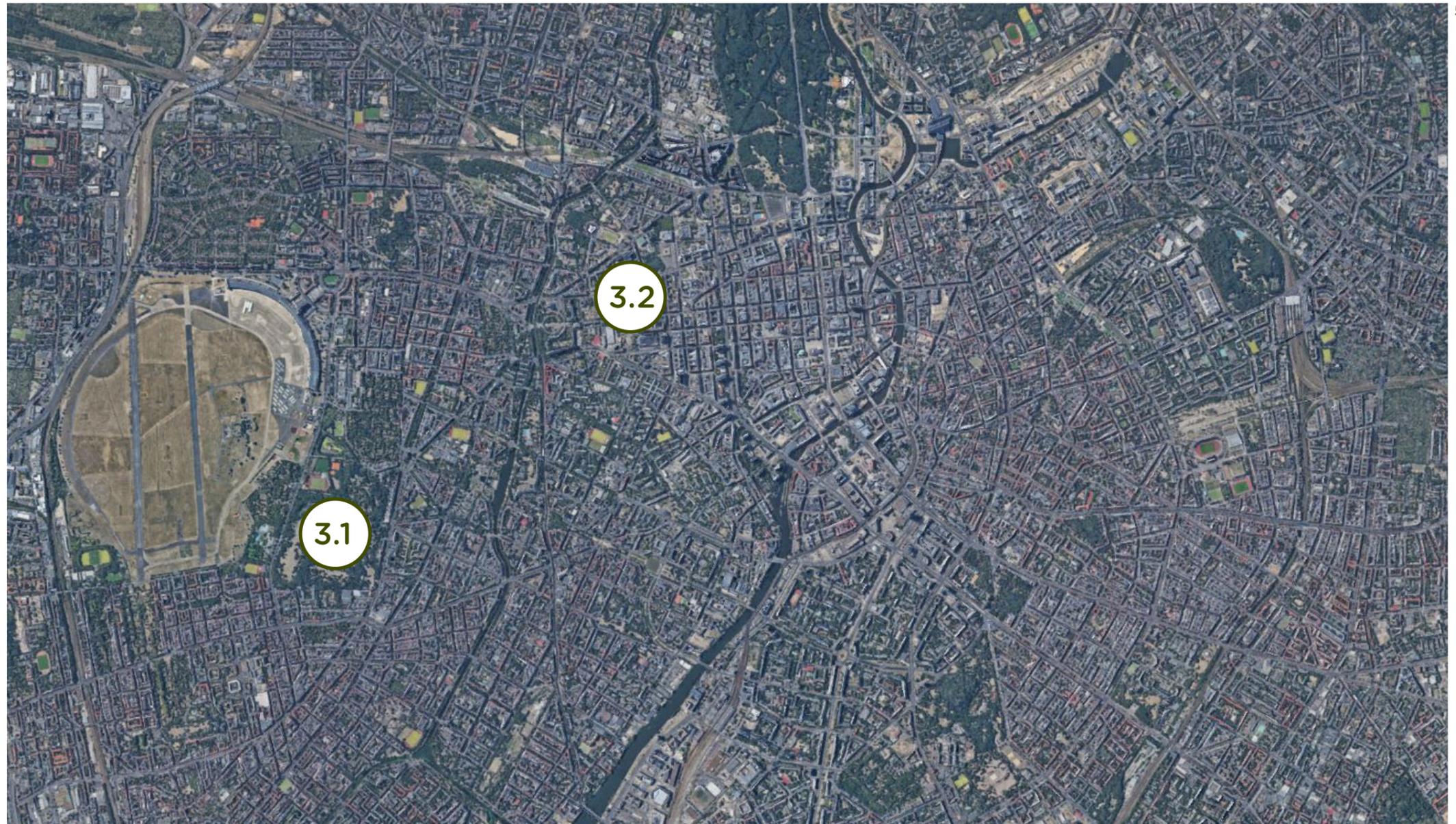
1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050

50 The capital city of Germany was first a capital of the Margraviate of Brandenburg of the Roman Empire between the thirteenth and eighteenth centuries, then of the Kingdom of Prussia up until 1871 when the German Empire was established, and Berlin became a centre of European power politics. In the years before World War I, the city was considered to represent the fullest application of science, order and method of public life in civic administration and organisation. Conscription of many farmers and miners to World War I left the rural tending of land bare and national food rations critical.

Between wars In the years of the Weimar republic, Berlin was a creative and cultural force of architecture, painting and writing with a vibrant nightlife. But a state of horror slowly emerged from the Great Depression that further escalated with the Nazi abandonment of the constitution in 1933 and along with it all sense of human rights. In 1942 Berlin and Germany were in a state of total war, where what remained of the entire non-military society was mobilised for war production. Berlin became an evil centre from which one of the deadliest human genocides was planned with calculation and executed across sites within and nearby the city limits.

This study is concerned with the values inherent in both formal and informal occupation of open space in Berlin. Prinzessinengarten and Floating University reframe the citizen as a catalyst for **commoning**, of working together toward or within collective aspirations in lived spaces shaped through human interactions that develop shared worlds beyond capitalist command. The two selected projects are connected through the spirit of Berlin as a migratory destination exemplar of diverse cultural narratives prioritising togetherness and shared pleasure above divisive structures.

The Berlin Strategy 2030⁷⁰ was published in 2015 following a condition report in 2013 on the current state of the German capital. It assembled expertise from the community, economy, science and politics to provide a planning model for the sustainable development of the City for the first time since German reunification in 1990 after the fall of the wall.



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The Arrival City Is on the Ground Floor

“The Success of a Neighborhood Is Determined by the Availability of Small-Scale Spaces on the Ground Floor.”

this page (top): graphic collateral for 'Making Heimat' German pavilion at the Venice Biennale, 2016
 this page (bottom): bill posters pasted on wall in Kreuzberg reads "honey is scarce because bees and ecosystems are dying"
 opposite: people watch a C54 plane landing at Tempelhof airport, 1948



The German pavilion of the 2016 Venice architecture Biennale Making Heimat (Arrival Country)⁷¹ responded to the fact that over a million refugees had entered Germany the previous year, a significant increase from previous years as the Country opened its borders entirely.

In three acts, the pavilion captured the structures to which refugees arrive, the conditions through which a refugee transitions to an immigrant and the spatial design concept of the German pavilion as a statement on the political state of a transitory population. Forty-eight tonnes of brick were removed from the protected pavilion, temporarily transforming it into an open-border structure.

Planning promises

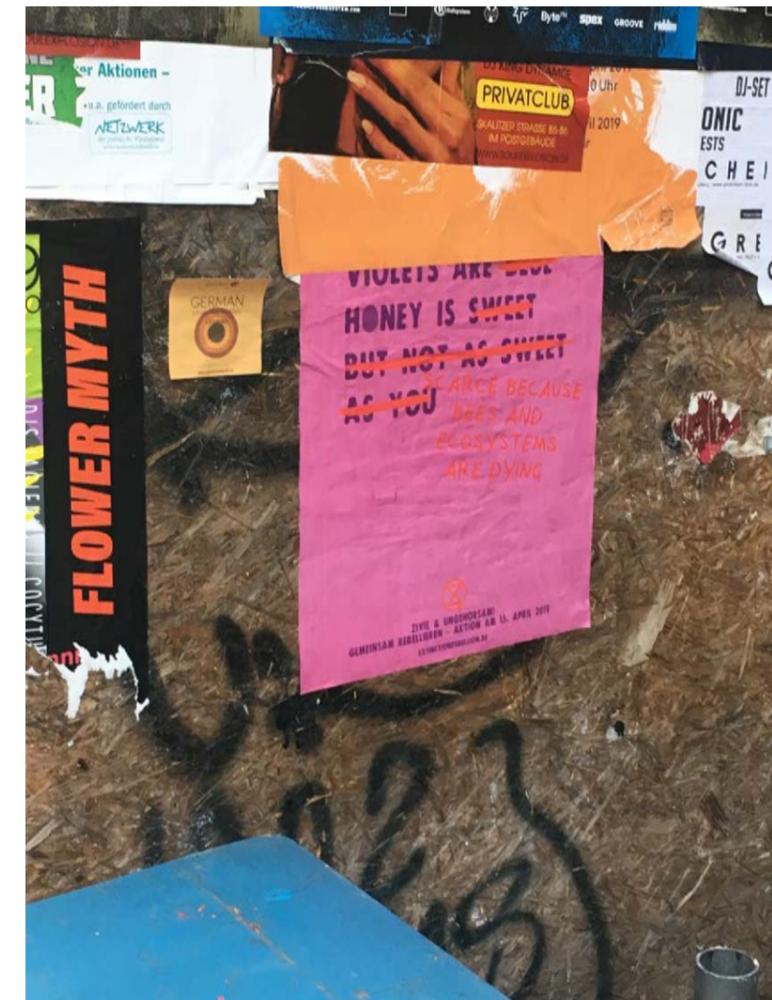
Acknowledging Berlin's unique creativity and ability to innovate and adapt, The Urban Development Concept Report Berlin 2050⁷² aimed to open discussion on major, long-

term issues like climate, open spaces, the economy and living conditions. It did so through a city-wide forum of face-to-face workshops and creative digital tools such as the **Berlin telegrams**, posted on advertising columns and distributed to workstations by email and letter as well as active debate on Twitter, text and other social platforms. The report outlines visions for the future, existing qualities to be enhanced and strategies towards aligning both.

Of relevance to this study are the vision for an urban, green and mobile city in which the city commits to climate neutrality by 2050, the quality of a green and compact city where vast tracts of open space like parks and community gardens are highly valued for recreation, health and biodiversity and two key strategies; city and green growing together and laying the groundwork for a climate-friendly city.

Berlin aims to have safeguarded its natural resources sustainably for the long-term with soil, air and water quality continuing to be vital criteria for development, and quantitative growth is claimed to be growing in parallel with biodiversity though it is unclear exactly how. Forty-four percent of the City tapestry is made up of woods, farmland, water, allotment gardens, parks and sports fields and every Berliner should live no more than five hundred metres from a green space.

'Street trees for Berlin' aims to plant ten thousand trees by the end of 2017. In 2011 over ninety-five percent of Berlin's power is sourced from fossil fuels including coal, oil and natural gas so priority is placed on a transition to renewable sources. Energy efficient building renovations remain a focus in this transition. The forty-four percent of sealed surfaces in the City that contribute to urban heat island effect are targeted as contributing to tropical urban temperatures and inability to capture carbon dioxide.



3.1 Floating University

REVISION (January 2020): Floating University will no longer be called a University, as this is considered a regulatory offence.

The Floating University⁷³ was established in 2018 by Raumlabor⁷⁴ in a rainwater basin on the decommissioned Tempelhof airport site on which the original terminal was constructed in 1927 and underwent massive upgrade during Nazi reconstruction. Flight service ended in October 2008 and the Tempelhof field was set aside for public recreation. The terminal served as an emergency refugee camp from 2015 when Germany opened its borders and welcomed an overwhelming migrant population. During heavy rainfall water from Tempelhof and contaminated runoff from the adjacent road Columbiadamm accumulates in the rainwater basin before slowly flowing onward to the Landwehrkanal. It is a third landscape on the verge of disappearance.



Escalating real estate prices in the surrounding suburbs of Kreuzberg and Neukoln has brought about both pressure for future development opportunities on the site as well as civic protest regarding the sell-out of open space in the area. A successful referendum in 2014 halted all construction plans for Tempelhof as a private development and invited a new modus operandi for inventing new typologies to live there instead.

The Floating University was established in 2018 as an open space laboratory for an urban practice experimenting with and questioning how to respond to local and global

crises. Far from an institution in the traditional sense, the Floating University is a series of satellite structures built by those who are invited to gather, learn and work there to envision an unknown future. In this imaginary framework, the kitchen, bar, auditorium, hot tub, library, forest, street and park are designed and built as the learning spaces which are occupied by visiting creatives and public events in the warm weather from May through September.



A developing Lexicon of terms written by visitors captures in public record the thoughts explored through practice on site, such as; change midwife, changephobia, co-caring, dead silence, food checkpoint, glocal knowledge, porous border, the sourdough effect, symbiosis and trauerflower.

“The term “Trauerflower” with its combination of different languages indicates that [the cut flower trade] is a transnational topic. About half of all cut flowers in Germany come from developing countries such as Kenya, Ecuador or Ethiopia and are transported to Europe by plane. Especially in these countries the workers are not paid sufficiently and suffer from unacceptable work conditions.”

What happens at Floating University?

Operating costs and building materials for structures of the Floating University are funded by the Senate Department for Culture and Europe. The campus sprawls across the whole basin on a variety of floating satellite structures connected by floating platforms that together rise and fall with unpredictable patterns of rain. An urban forest designed by Japanese architects Atelier Bow Wow is a gathering space for eating and conversation, equipped with a kitchen and first floor workspaces. A laboratory tower lays out the site's water filtration system as an experimentation hub for exploring future use of rain and greywater. Water is continually turned by a giant wheel through filters of plants, biofilm, mushrooms, sand and gemstones and extracted for use as irrigation, baptism, toilet flushing and cleaning.



this page (top): the forest, central structure of FU by Atelier Bow wow
this page (bottom): water filtration chain system at Floating University photograph Katherine Ball
opposite (top): participants in the Climate Care 2019 program, source: FU
opposite (bottom): cycling in to Floating University

As visiting studios, artists in residence and local volunteers occupy the site, new structures for postulation are formed on site. In its second year of operation, the Floating University watched and learned over the course of a year how a nature culture or third landscape had formed as an urban oasis where rising and falling water levels welcome a variety of human creativity and participation, animals, plants and algae. The 2019 **Climate Care**⁷⁵ program occupied the site over a summer August week with reading groups, light and sound installations, an insect feast, timber and algae building workshops, bee farming and visiting schools. Care in the program reframed the human as caretaker of the recuperation of the planet by recognising the fragility of bonds between humans and non-humans. According to its curators;

“As changes in weather patterns are experienced in ways that can no longer be ignored, public awareness has reached a tipping point and civic action is picking up in Cities around the world. The recognition of changing climate systems in a mainstream discourse is not some grand discovery, but more a process of catching up with marginalised environmental movements which have long been advocating for change.” - Climate Care





Urban Ecology at Floating University

The site of Floating University is not just an aqueous surface on which experimental spatial practice takes shape but a piece of urban infrastructure that has long been hidden from social contact, whose unpredictable form is magnetic to the cycles of rain and demands its occupants to enquire about its fluctuations and how they can be reused and reformed. It invites participation by constructing water catchment and filtration systems that feed to the kitchen, bathroom, auditorium and greenhouse plants. Water is processed through a downward spiral of nine bathtubs where a membrane filter transforms rain to potable water and a moving bed reactor filters dirty dishwater to irrigate the thirty-five varieties of tomatoes growing in the Greenhouse.

Water is divided and treated in four different categories on site; Rainwater that collects pollution, sulfur dioxide and nitrogen oxides on its descent from the sky through the atmosphere is collected for reuse. Basinwater is the cocktail of automotive oil, cigarette ash, bin juice and rubber that seeps into the site from its neighbouring landforms, roads and roofs on which the institution



this page (top): participants in the 2019 'Climate Care' summer program out in the basin, source: Lena Giovanazzi photography
this page (bottom): students from Eindhoven University working on an Onsen structure in Spring 2019
opposite (top): Climate Care pamphlet cover, source: Floating University
opposite (bottom): gathered together for chilli on my visit in April 2019

drifts. Greywater contains the residue of the lotions and potions with which we mix it. Blackwater has entered a relationship with human waste and all its nutrients and pathogens. With aerobic decomposition it can be turned into fertilizer to make gas for cooking.

Floating University prefers to mimic the flows of water in natural ecologies rather than the invisible, submerged piping of the industrial City by catching, filtering and reusing it to meet its programmatic needs. Expert knowledge of the treatment of liquid flows that fuel life on earth was shared on-site through 2018 in public workshops for growing biological filters, constructing wastewater sewage treatment plants, a water ritual event and a two day water working group on the future of rain use.

Floating University: a living structure

Unsure exactly what kind of university campus was operating from a small and secluded urban body of water, I showed up uninvited to the rainwater basin on a Wednesday afternoon in early April of 2019 with complete curiosity. Two entirely disconnected friends living in Berlin had shared with me animated memories from the previous summer's events and I needed to find out for myself. I followed directions from an open call for extra hands on a Facebook post to Lilienthanstrasse to find the site active and interactive, less an institution than an outlier excursion site that imprints your memory longer than any classroom lesson. A scattering of drop-

in volunteers, a sprinkling of the extended Raumlabor crew as well as a visiting studio from Design Academy Eindhoven in the Netherlands were already divided and working on interventions across the swampy territory. All were well into the day's work constructing several fresh structures for the 2019 curriculum of Floating University including a Japanese Onsen, a culinary upgrade to the Urban forest kitchen and amphitheatre seating.



After confirming I could work power tools and a sewing machine and signing an acceptance of risk, I was joined with Jaan resealing the floor and raising new joinery for the summer kitchen. A self-employed carpenter who shows up at Floating University from time to time, Jaan first crossed over with members of Raumlabor in the early nineties as squatters in various locations that sat vacant after the fall of the wall.

We whiled away the afternoon sketching, chatting, cutting, forming, drilling and all coming together from satellite tasks for a huge pot of chilli and leisurely cups of coffee. I left with the sun and a handful of new friends, feeling more relaxed but just as accomplished as any day I remembered leaving University. In the process of making, learning is active and reflective and you find simpler and more creative or efficient ways to work with each line, cut and conversation. When a workshop is transplanted to a site where every drop of water is harvested to coffee and you see your blackwater going places is another layer altogether of spatial understanding.

3.2 Prinzessinengarten

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this page (top): Berlin 'Screbergarten' allotment garden in the 1970s as a private enclave of leisure
 this page (bottom): tools set for planting at Prinzessinengarten
 opposite: (top) planter boxes at Himmelbeet
 opposite: (bottom): naming equipment out on the table at Prinzessinengarten



Berlin is a densely populated City where many reside above the ground floor, elevated from land which permits the cultivation of produce in ground. Its citizens have formed a spatial network to counteract this challenge, in hundreds of community and allotment gardens scattered across the suburbs of Berlin. I spent an early Spring Tuesday tracing a circuit of Berlin's community gardens Himmelbeet and Prinzessinengarten via the allotment gardens of Borholmer Strasse encircling the location where the Berlin Wall first fell in 1989.

Organisations first began allocating open plots to allow impoverished families to garden in the early nineteenth century in almost twenty German Cities. Beyond the source from which food came to the table, the gardens served as a forum for relaxation and play. When Germany reached a state of total war in the early nineteen-forties, rural farms and agricultural plots had been abandoned as a result of their stewards' conscription. In this context, transportation of produce to Cities proved difficult. Urban allotment gardens, Schrebergärten, offered survival mechanisms to citizens in this time, especially after World War I when Germany passed a law protecting the small gardens by alleviating their leasing fees.

Throughout the post-war economic boom of the sixties many people in West Germany viewed the ability to purchase food instead of growing and preserving it from urban vegetable gardens as a symbol of social status. In 1983, the federal German parliament passed the Federal Allotment Garden Act supporting gardens for non-commercial, personal horticultural use located among community facilities including paths, play areas and club houses. Garden organisations are recognised under this act as non-profit and supportive of the gardening of allotments and the professional support

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of its members. A Garden under its definition should be no larger than four hundred square metres and should consider interests of environmental protection and landscape management. Each allotment is permitted a simple gazebo of an area no larger than twenty-four square metres that must not serve as a residence, leaving at least a third of the plot to harvest. Although regulations for leasing an allotment differ between sites, quiet periods are in place over the hours of lunch, after dinner and throughout the entirety of Sunday.

Rurbanization

"Urban gardens have opened the way to a "rurbanization" process that is indispensable if we are to regain control over our food production, regenerate our environment and provide for our subsistence. The gardens are far more than a source of food security. They are centres of sociality, knowledge production, cultural and intergenerational exchange." - Silvia Federici⁷⁶

Prinzessinengarten is a common garden that has occupied a city-owned plot of six thousand square metres for a decade. **Nomadic Green**⁷⁷, the partnership of Marco Clausen and Robert Shaw, injected new life into the disregarded urban brownfield that had been a dumping site for half a century.



Uncertainty of the site's permanence led to the development of an infrastructure for raising vegetables from seed in mobile crates that could be transported anywhere for sale and consumption. A transitory crop rotation that enlists the agricultural values of Berlin's rural migrant population while advocating for the social

and economic component of sustainability as necessary. Located on a Kreuzberg corner by the Moritzplatz roundabout and U-Bahn, the site is an open edge through which citizens flow. Tools, tables, books, soil, seats, seeds and discarded objects are available to neighbours, students and visitors to create with. A thirty-thousand signature petition saved the community garden from closing in 2012, a moment when the Berlin Property Fund sought a buyer on behalf of the Senate for the government plot.



this page (top): library of information and seed storage in Prinzessingarten
this page (bottom): common spaces are in a constant state of flux, Prinzessingarten
opposite: (top) assorted box of seeds to be planted
opposite: (bottom): spring in bloom at Himmelbeet

Commoning

What is a common space and why are more common spaces emerging? The community garden is a common space, more so than a public park or allotment garden.

Through the eyes of Athenian architect, activist and researcher Stavros Stavrides, Common Space⁷⁸ is the exploration of emerging potential for resistance and creative alternatives outside contemporary forms of domination in today's Cities. It is an active space open to public use where rules and practices of use are constantly reinvented by those defining them rather than by a prevailing authority. In the global context of government corruption, unjust climate policies and exploitation, it asks how people move beyond expressing their demands to organising their common life through action.

Participation and involvement of people acting within an established and agreed series of practices are both required for space to be common. Common space is physical, but it is also digital, open source, and social, as evident in the Creative Commons (CC) license format that enables free distribution of otherwise copyrighted material. Authors use this form of public copyright licensing to share, use or continue building on work that they have created. Mundraub.org is a webpage that illustrates how digital and physical common space are intertwined, by geotagging locations of trees whose fruits are near ripe and are freely available for picking.

Urban gardens are used and managed as common spaces even if gardeners do not personally own the land or define its masterplan. The incomplete design of common spaces is ensured through continuous and unplanned intervention that collects the diverse skills and knowledge of its participants. The idea of the amateur is celebrated. In the common garden, people ask questions of raising, feeding, selling, sharing and



eating seasonal and fresh produce not with their eyes and their money but with their hands. They contribute to the process of making the food they later eat. Nomadic Green are the stewards of the rules of commoning that ensure Prinzessingarten remains open to engagement.

“The common is the basic foundation of ecological thought against which the singularities of specific locations stand out in social and economic thought, however, the centrality of the common is not widely recognised. The claim for its centrality relies on the hypothesis that we are in the midst of an epochal shift from a capitalist economy centred on industrial production to one centred on what can be called immaterial or biopolitical production.” - Michael Hardt⁷⁹

The Tomato Trail

Constructs of the perception of time and quality are blown open in the community garden. Planting a tomato seed and patiently awaiting its fruit unveils the complexity of the very real context of putting fresh food on the table in the cosmopolitan City today. An individual can walk minutes to a store where dozens of washed and polished tomatoes of different varieties, probably kept plump and cool while shipped from a faraway land, are ripe and readily available at the cost of loose change.

The difference is so radical but over time has become so normalised through the incredibly urban perception of abundance and readiness promoted by the supermarket and the marketplace. Many tomatoes did not qualify for the journey from the farm to the display arrangement and of those that met the standards of sale, many will not be selected by consumers and so discarded. Biting into a tomato fresh from the vine is incomparable to the readily available product whose flavour dissolves through the varied atmosphere of its journey.

How does a space remain common? Common space cannot be fixed in the form of a product, the tomato is not the commons but the community garden in which it was raised can be. The production and use of common space cannot be separated. The public park managed by authorities are not common space because they block the inventive and liberating potentialities of commoning practice. Their rules are fixed and systems controlled.



4.0 Rotterdam

4.1 Test Site Rotterdam

4.2 The Missing Link

2016 A Circular Economy
in the Netherlands 2050

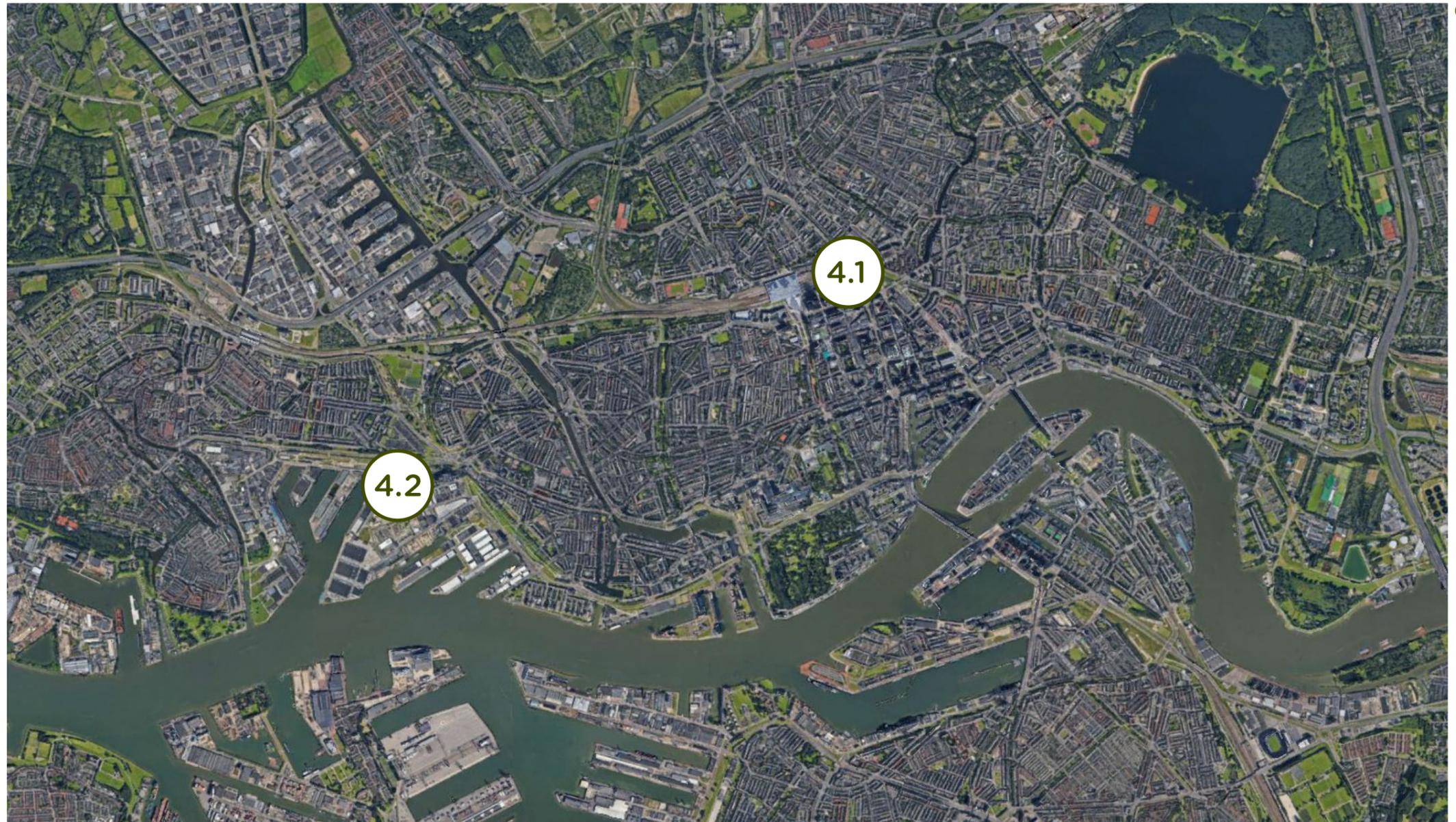
1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050

62 Since a dam was created in the Rotte river in 1270, Rotterdam has remained a water city. The Rotte itself takes its name from 'muddy water' and flooding in the area around 1150 prompted the creation of protective dikes and dams. Around 1350 the Rotterdamse Schie shipping canal was built to provide access to larger northern towns and transformed the City into a shipment transit node between the Netherlands, England, Belgium and Germany.

Sitting at the mouth of the Nieuwe Maas entering the North Sea, Rotterdam is the largest port of the Rhine-Meuse-Scheldt delta and of Europe. The delta is the access network from the central European hinterland to the rest of the world via the North Sea. The land areas of the delta have remained stable under the protection of the Dutch Delta Works but now changing climate patterns are threatening unpredictable scenarios of both flooding and drought. The effect of an extreme case of flood or drought on land and urban ecology in the Rotterdam region will be as far reaching as the entire delta network.

Often referred to as the 'gateway of Europe' where transit routes of land and sea converge, the City is a melting pot of diverse cultures and produce. Over six hundred thousand people call Rotterdam home and over half of them have migrated from almost two hundred countries outside the Netherlands including Suriname, Turkey, Morocco, Indonesia and the Caribbean. Rotterdam, Amsterdam, the Hague, Utrecht and eighteen smaller municipalities collectively form the Randstadt, a dense megalopolis with over eight million inhabitants.

In an effort to break Dutch resistance during the German Invasion of the Netherlands in World War II, a devastating aerial bombardment of the City in May 1940 came to be known as the Rotterdam Blitz. Nine hundred people were killed in the blast and eighty-five thousand left homeless with the destruction of almost the entire historic centre. German forces had considered the Netherlands an ideal midpoint from which they could attack the British Isles by land or sea.



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Planning Promises

A Circular Economy in the Netherlands 2050⁸¹ was implemented in 2016, with an interim objective of reducing half the use of primary raw materials - fossils, minerals and metals - by 2030. In such an economy, the country will use and reuse raw materials with no emissions and only extract raw material by 'sustainable' means when required. In this context, products and infrastructure must be designed in a way that minimises the loss of their value and ensures their parts can be maintained, replaced and recycled with ease.

The circular commitment is more ambitious than planning policies for many other Cities like New York and London who outline the need to reduce or eliminate fossil fuel emissions without an imaginative or practical structure for how. In making necessary a process of revaluing and reimagining existing skills and materials beyond extractive methods, it moves from a survival mechanism to a future framework scaled from the individual value system through the collective community and stakeholder group to a national level of regulation and planning.

I will spare the familiar rigmarole of population growth projections for Cities and pause fast forward at the moment where the Netherlands outline the risk of transitioning more people to a technology and electricity driven society dependent on extracted raw materials. It is real.

The circular economy report reveals that in the last century, humans started using thirty-four times more materials, twenty-seven more minerals and twelve times more fossil fuels. Of the fifty-four materials critical for Europe, ninety per cent depend on importation from China and their limited availability in the future will lead to geopolitical tension and an inequality to access.

The strategic goals required in the transformation are; 1. Raw materials in existing supply chains must be used in a high quality manner, 2. Where raw materials are needed, fossil based and non-sustainably sourced and produced raw material must be replaced by sustainable, renewable and generally available alternatives and 3. new production methods, new products and new modes of organisation must be developed alongside new modes of consumption.

Building a Sustainable Port⁸², published by Rotterdam Port Authority in 2007 admits the responsibility it must assume for twenty percent of Dutch greenhouse gas emissions and the site of Europe's largest petrochemical complex and has committed to reducing emissions by eighty to ninety-five percent under the Paris agreement.

this page: 'het Nieuwe Tuin (the new garden) at Het Nieuwe Instituut, Rotterdam
opposite (top): aerial photograph of the damage after the Rotterdam Blitz
opposite (bottom): shared neighbourhood gardens in west Rotterdam residential

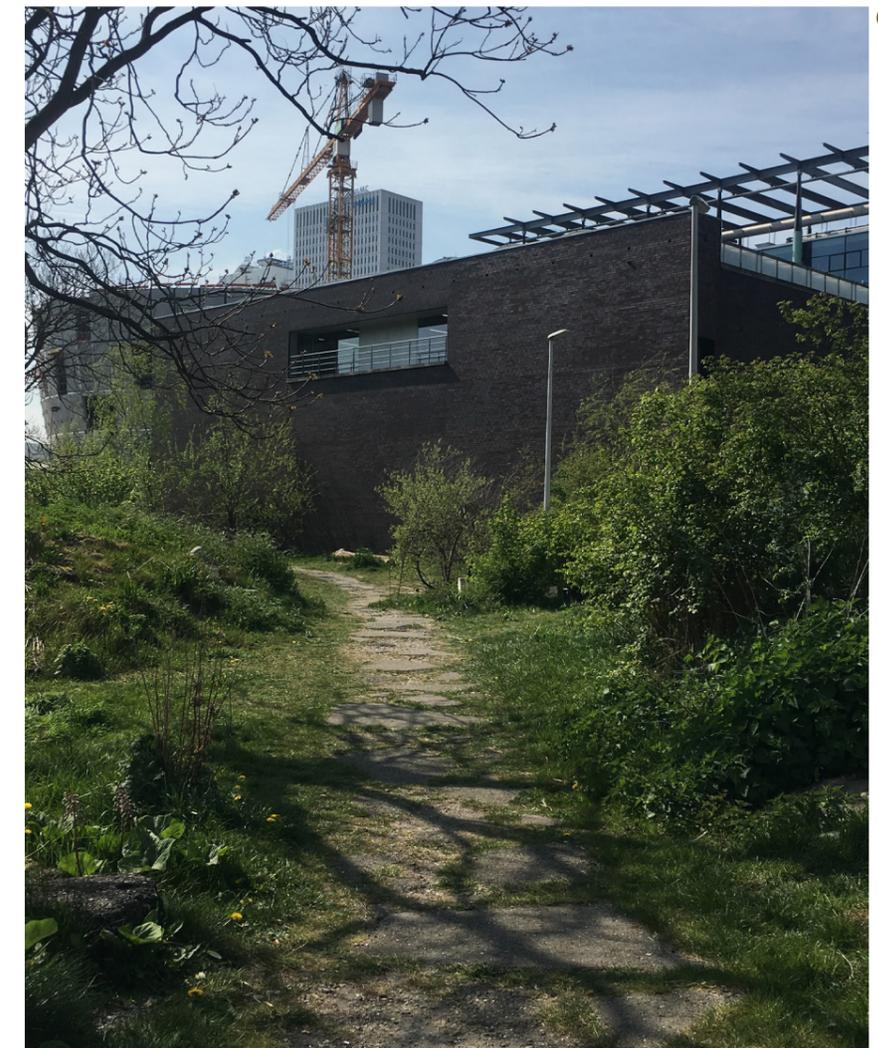
Despite having remained neutral in War, threat of the destruction of Utrecht after the Rotterdam Blitz led to the capitulation of the Dutch government. Intense reconstruction of the City took place between 1945 and 1968 with the vision that;



“Rotterdam will be spacious, it will have the elegance of a metropolis: the speeding traffic, the broad boulevards, all the tall buildings will generate a sense of bustle that blends harmoniously with modern life.” - Rein Blijstra, 1952⁸⁰

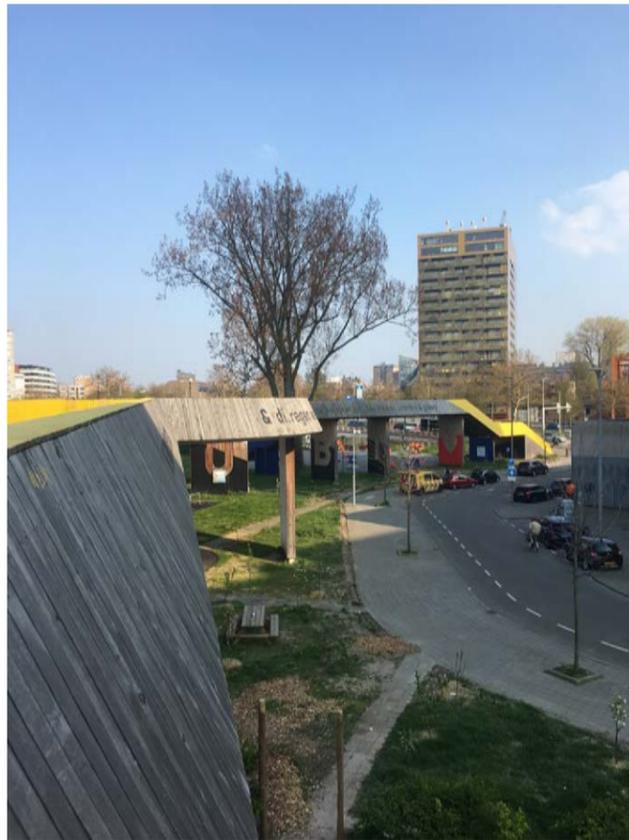
The spirit of Rotterdammers has remained bold since the blitz though the preference for modernism that laid the foundation

for the new city turned critical toward the late sixties, underlined by a craving for vibrancy, landscape, residential quality and public amenity. The City today is a tapestry of eclectic architecture and infrastructure, icons, remnants of reconstruction and parks straddling its waterways. The port itself as the economic centre lies beyond the perception of the citizen as it moves further west and has become largely automated.



4.1 Test Site Rotterdam

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this page: Pompenburg Park beneath the Luchtsingel public bridge
opposite (top): aerial image of the Test Site Rotterdam, source: ZUS
opposite (bottom): Hofbogen park atop the former railway line

It must have been a surreal experience to walk the empty, developing streets of Rotterdam and imagine the valley that once framed a streetscape of familiar buildings. A critical position on the value of preserving existing structures emerged in Rotterdam when buildings of the reconstruction period started to be demolished in favour of more contemporary replacements. Although the former structures were modern and practical and invited critique on a building's social contribution to the City, a momentum of working with what existed had already become engrained in many Rotterdammers that had witnessed massive loss.

As in Australia, the government of the Dutch political system holds office for four years during which it manages both short- and long-term planning which can become fragmented and discontinuous with shifting preferences. In an unsolicited open letter to the incumbent minister for transport, spatial planning and the environment, Zones Urbaines Sensibles (ZUS) called for the introduction of a strategy for surface water and suburban development that could endure the tide of governmental change and allow an emergent spatial planning policy.

'Test Site' became a laboratory for city making as a response to the lack of strategy for gradual transformation in the urban plan for Rotterdam released in 2008. Test Site aimed to realise long-term ambitions in the short-term through temporary interventions that occupied what had become a forgotten, underinvested and underappreciated area of the north-east of central station. Testing began with an alternative business plan to revitalise the empty, multi-storey Schieblock with entrepreneurial tenancies that would take part in the ongoing experiment, such as International Architecture Biennale Rotterdam (IABR), dance education platform dependence, making laboratories and creative studios. From there, design planning and funding models were sought and structured for the subsequent interventions; rooftop farm, public parks, hospitality venues and the restoration of the Hofbogen former rail line into a public park.

What happen at Test Site Rotterdam?

The Schieblock is a seven storey mixed-use creative entrepreneurial tenancy stack sandwiched by cultural and commercial shopfronts on ground floor and an urban farm and restaurant, Dak Akker, on the roof. Its tenants include the International Architecture Biennale Rotterdam (IABR) and ZUS, both teams behind the case studies presented here.

The Luchtsingel is a public pedestrian footbridge network that begins on ground by Central, transforms into a public amphitheatre at the outdoor zones of Club Annabel, BAR Rotterdam and Biergarten before piercing the Schieblock on the first floor. From there it forms a pedestrian link elevated over the road and rail line to the Hofbogen and Pompenburg Parks. The wooden planks that form the bridge were made available for public purchase in 2012 through a crowdfunding structure and are engraved with personalised signatures, love notes, company branding and jokes of those who collectively funded them.

A single plank was worth twenty-five euro, 125 for a sectional profile of the bridge and 1250 for a one metre section. The design and realisation of the bridge took two years. Alongside the realisation of the project, ZUS worked with the municipality and a team of specialists to take care of the ongoing implementation and management of the Test Site at large.

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'Permanent temporality' means the individual injections and gestures of the project were never intended to last longer than ten years, though the networks, relationships and systems those structures formed were intended to be more permanent. Seven years of massaging this alternative approach to City-making has generated interest in the future development of the site, to maximise on its floor area in a way that retains what existed and multiplies its diversity.

"Urban commissions can no longer be limited only to spatial interventions; solutions also have to be socially and ecologically responsible. Or you must engage in local politics, so that all aspects of the location can be firmly embedded. The current trend towards specificity offers no answers to these questions." - Re-public ZUS⁸³

Urban Ecology at Test Site Rotterdam

While Test-Site Rotterdam prioritises spaces for city making by its citizens on a participatory scale, the evolving project has done so in a way that secures a collection of public parklands that collectively form a connected network for biodiversity. This Network begins on natural ground in Park Pompenburg where the Art-Deco Pompenburg station stood before the Rotterdam blitz. It is here in a living carpet of ground covers where the legs of the Luchtsingel stake their claim and above which people are transported over railway infrastructure between the central and northern districts of the city by the temporary yellow timber bridge. Stepping off the Luchtsingel on the North, one finds themselves in a meadow of wildflowers and a grove of fruit trees by a pavilion that once sheltered passengers awaiting the train.



In 2018 the Luchtpark reopened the roof of a former railway viaduct built between 1904 and 1908 that once transported Rotterdammers to the seaside at Scheveningen, calling at the Hague on its way. The journey of leisure beyond the City began above a reinforced concrete viaduct that to date spans almost two kilometres through Rotterdam North.

Realising the construction of the civil project in cast reinforced concrete required the establishment of a specialist concrete company - the Hollandse Beton Maatschappij. The vaulted spaces beneath the first electric railway line in the nation were designed at intervals wide enough to allow both continuing flow of traffic and tenancies generous

enough to be leased as commercial shopfronts that could generate income for the construction of the structure itself. Occupants of the arched viaduct today include the dance club Bird, record store Clone, urban bakery rotterdam, Het Lokaal coffee house and a plant store designed by ZUS. Scattered throughout the five thousand square metres of Luchtpark Hofbogen are trees of plums, prunes, pears, apricots and apples.

Set atop the Schieblock with access via the shared workplace's vertical circulation is the largest open air farm in the Netherlands and one of the largest in Europe, with a thousand square metres of vegetables, edible flowers fruits and bee Hives. DakAkker translates from dutch to english as rooftop farm, a planted space that surrounds OpHetDak, a public cafe that serve dishes of produce foraged straight from farm to table. Flowering plants of the urban farm create an environment for the pollinating bee colonies of the DakAkker to source enough nectar to harvest honey.

Test Site Rotterdam: A living structure

As no small area is left to waste in the ever-expanding test-Site Rotterdam project, even the rooftop of OpHetDak was retrofitted in 2016 to perform as a smart water collection network. The system creates an expanded infrastructure between the roof surface and planted layer that collaborates with weather forecasting technology through a smart phone application. In predicted events of extreme rainfall the system transfers stored water twenty-four hours in advance to a secondary reservoir to accommodate incoming rain in the system in order to alleviate pressure on sewer systems prone to flooding.

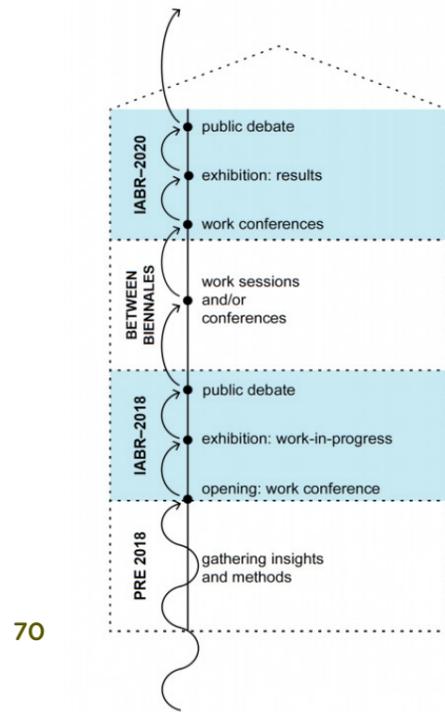
Intervening on a rooftop is an architectural gesture that essentially optimises solar energy collection on an isolated, barren surface that would otherwise contribute to Urban Heat Island Effect and redirects it to an ecosystem whose population can photosynthesise and take part the cultivation and education of food in shorter cycles than the global western norm. I took a wander around the nebulous landscapes of the Test Site with Joan Almekinders, a landscape designer at ZUS on a spring morning in April. He explained their ongoing maintenance is managed by the Rotterdams Milieucentrum, headed by the DakAkker's beekeeper Wouter Bouman. The program collects a variety of participants in the horticultural upkeep of outdoor spaces, including school workshops in the rooftop farm, beekeeping courses, staff at the DakAkker as well as many volunteers weeding and planting throughout the seasons. A silent reader's thankyou to all those wonderful people.

Rotterdam is a city I formed an appreciation for well before the seed had been planted that allowed this research to proliferate. My perception of the role I imagine the practice of architecture to encompass expanded elastically in this city. In 2016 I was living in West Rotterdam and working in the studio of ZUS, transplanted in the multicultural evolution of the Test-Site and a City strangely obscured from its economic centre - the Port. Under the most unlikely historical circumstances, the Rotterdam I became familiar with continuously insisted on not being taken too seriously while at the same time proved to be deeply serious about how humour, creativity and diversity moved through it.



this page: Op Het Dak, the Dakakker rooftop farm above the Schieblock, test site Rotterdam
opposite (both): details of Pompenburg Park beneath the Luchtsingel

4.2 The Missing Link



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“Water is probably the most tangible concern for politics and spatial planning. It involves both international relations and local interventions at the level of the living environment. Water is a matter of experience, setting boundaries, connections and consumption all at the same time. None of this is new for the Netherlands.” ZUS⁸⁴

The Netherlands depends heavily on coastal defence infrastructure, as twenty percent of the country lies below sea level and fifty percent is less than a metre above that level. The catastrophic flood of 1953 caused over two thousand human and thirty thousand animal deaths as well as damage to almost fifty thousand buildings between the Netherlands, Belgium and the United Kingdom.



The event called for an immediate reimagining of the Delta network, sooner than the parliamentary system was engineered to respond. Operating beyond normal planning procedure, a Delta School was established to intersect expertise with technology in research and design experiments that led to an official Delta Act and subsequent editions of the Delta Programme that continue to date.

The length of dikes exposed to the sea have been reduced seven hundred kilometres by blocking estuary mouths in the Netherlands. To steer investment in flood defences, a conceptual framework has been developed that identifies areas to be protected, assesses cost of flood damage to property, production and lives lost. The value of a human life is valued at over two million euros for the purpose of this model. Using data from a flood simulation lab paired with empirical data on the behaviour of waves, tides and storms, the chances of significant flood in each area are calculated.

A report on the Delta Programme in 2019 reveals that if global warming is controlled to a maximum of two degrees as set out in the Paris Agreement, the sea level along the Dutch coast may rise between one and two metres by 2100 in which case flood risk management and freshwater supply taskings will be larger than assumed in the Delta Programme.⁸⁵

The International Architecture Biennale Rotterdam (IABR) is an event-based platform for knowledge sharing that places the city in the context of climate change and increasing social inequality. Once every two years, the IABR curates a theme relevant to urban pressure and produces research to inform decision and city making in two formats; the public program of the Biennale as event and long-term research Ateliers that feed into each other over different durations.



this page: entrance to the Missing Link IABR home site at M4H
opposite (top): graphic of the milestones for the dual Biennale of 2018 - 2020
opposite (bottom): photo of the largely automated Port of Rotterdam

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The most recent IABR has been curated as a double diptych where Rotterdam and Brussels allowed their Biennales to crossover national borders of the Delta network over the years 2018 and 2020, using the interim period to work on responses to questions for the former that could be aired in the latter. The Missing Link in 2018 was designed to feed into Down to Earth in 2020, revealing a gaping question mark between proven shortfalls in water and energy management.

What is the Missing Link?

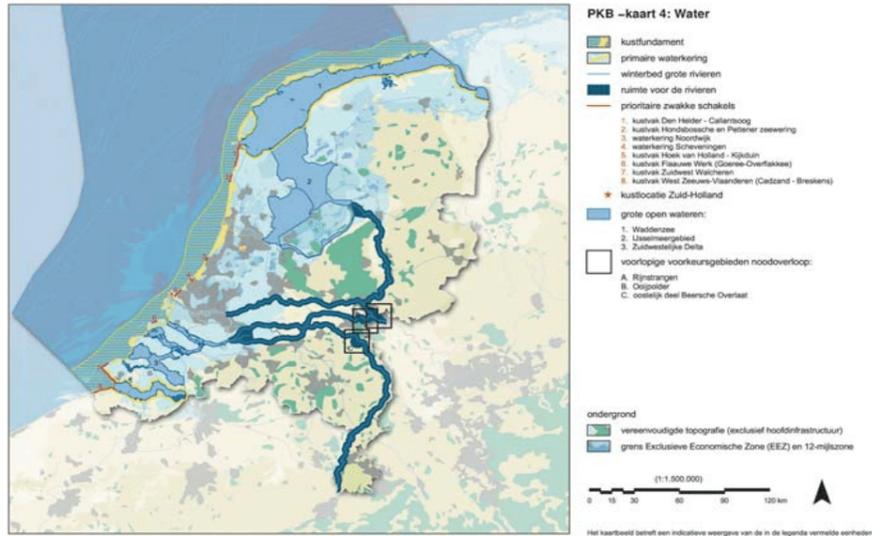
“Adjusting our way of life to the planet’s capacity is essentially a creative process that involves every one of us. The cultural free space of the biennale offers opportunities to think beyond what is described as realistic today. Designers are challenged to imagine this ‘beyond’ together with citizens, policymakers, scientists, and companies.” - The Missing Link⁸⁶

In Rotterdam the Biennale of 2018 occupied an industrial precinct between the City centre and the Port with exhibitions, debates, lectures, workshops, conferences, bicycle and walking tours all operating from the central site of MH4+. Rotterdam design Studio Makkink & Bey

opened their studio over six consecutive Fridays for a working exhibition to establish a Water School in the area that intersected topics of water and education through six themes; clean, grow, harvest, make, build and document.

In line with Rotterdam’s circular port and the Netherlands circular economy, the ‘Keile Collective’ offered field trips and workshops and hosted lectures with businesses and entrepreneurs in the city addressing issues such as waste, water, food and circular area development as part of the 2018 IABR. In the second format of the project, over forty practices came together as the Delta Atelier to prepare a conference for the closing of the 2018 Biennale that set the research agenda for the years leading to the second instalment of the diptych. The necessary spatial transitional leap to accelerate change is being explored in six domains; renewable energy landscape, healthy agriculture, caring living environments, space for biodiversity and water, a new mobility system and a reproductive city.

I met with Jelte Boeijenga, director of research and development for the IABR in their Rotterdam office in the Schieblock to discuss how the missing link was patching the void the program had deliberately placed itself within. In the partnering City of Brussels, the former World Trade centre became an incubator for transitional imagination through an open call to use the space for the duration of the Biennale as a post-work workplace for diverse ideas, places and practices that forge new



links and facilitate new coalitions. Architecture Workroom, a local Brussels studio, curated the event under “You Are Here”⁸⁷ with a poignant welcome address that spoke directly to the individual and at the same time to the giant question of how to address the space of the missing link.

Urban Ecology in the Missing Link

The void that inhabits the question of the missing link in vast. Curiosities that tentacle from searching for the missing link include; How can designers respond to human-made climate change? Can we raise sufficient social support to ensure that

change will actually and swiftly start to happen by designing the necessary transition appealingly and convincingly? How will the energy transition take place? How can the UN sustainable development goals and commitments to the Paris agreement play out in design that cares?

“A clearer distribution of roles between government and market and better cooperation between different authorities creates scope for a richer urban fabric. The authorities resume their responsibilities and can once again implement major public works, supported and inspired by various autonomous elite units of experts assembled for a specific task.” - TML⁸⁸

The Delta network is a super-scale project whose medium is fluid. Its posts are constantly moving and needing to be recalibrated according to changing weather and urban conditions. The scale of the system exceeds architecture and even urban planning in that it flows across transnational borders of planning rules and design codes. Rotterdam and Brussels admit

together the nebulous challenge of the Missing Link and then divide sites of the Biennale exhibitions and Ateliers across the two nations at a finer grain.

“It is an undeniable fact that we can only realize the transition if we can translate this huge challenge into bite-sized tasks and assignments at various scale levels: challenges people can actually address at all levels, ranging from neighbourhoods and districts to urban regions, deltas, and the world”- TML⁸⁹



72 **this page (top):** weak spots of the dutch coastline with ‘Ruimte voor de Rivier’ in dark blue’, excerpt from publication ‘the coast’ by Rob Roggema
this page (bottom): Ruimte voor de Rivier intervention by ZUS high water line bridge
opposite (both): typographic posters for the 2018-2020 Biennale by studio de ronners

Ruimte voor de Rivier - Room for the River is a national precedent for compartmentalising the super scale into parcels of a whole that traverses different provinces of the Netherlands and pinpoints sites for local intervention along the way. After the floods of 1995, the project invested over two billion euros over twenty years. Ten were spent researching and formulating a toolbox of nine flood protection measures⁹⁰ and a further ten realising their application in over thirty nodes in the network.

The Missing Link: a necessary conversation

‘Room for the River’ commissioned various offices of design, architecture and engineering to design and execute innovative new structures and modifications to existing systems in a site covering four rivers; the Rhine, the Meuse, the Waal and the IJssel. Interventions of the masterplan included relocating dykes, lowering the floodplain level, reducing height of the groynes, constructing a green channel to serve as a flood bypass, increasing the depth of side channels and removing obstacles in the river network.

The Rotterdam-Maaskant prize is a biennial prize awarded to a recipient who significantly stimulates debate on architecture, landscape design and urban planning with publications, education or commissioning. In 2018 the Maaskant was awarded to all politicians, designers and participants in the Room for the River program for their collective contribution to protecting the Delta region against flood and at the same time improving spatial quality.

“In addition to celebrating a unique and extremely valuable program for the Dutch landscape, the jury sends an important signal with its choice: the power of such an approach is still too little recognized in the Netherlands. Room for the River is the proof that spatial quality is not a luxury, but with the right approach, perseverance and safeguarding of the most important principles, it adds an important value to Dutch society and guarantees our landscape and the Dutch culture of living with water sustainably.”⁹¹

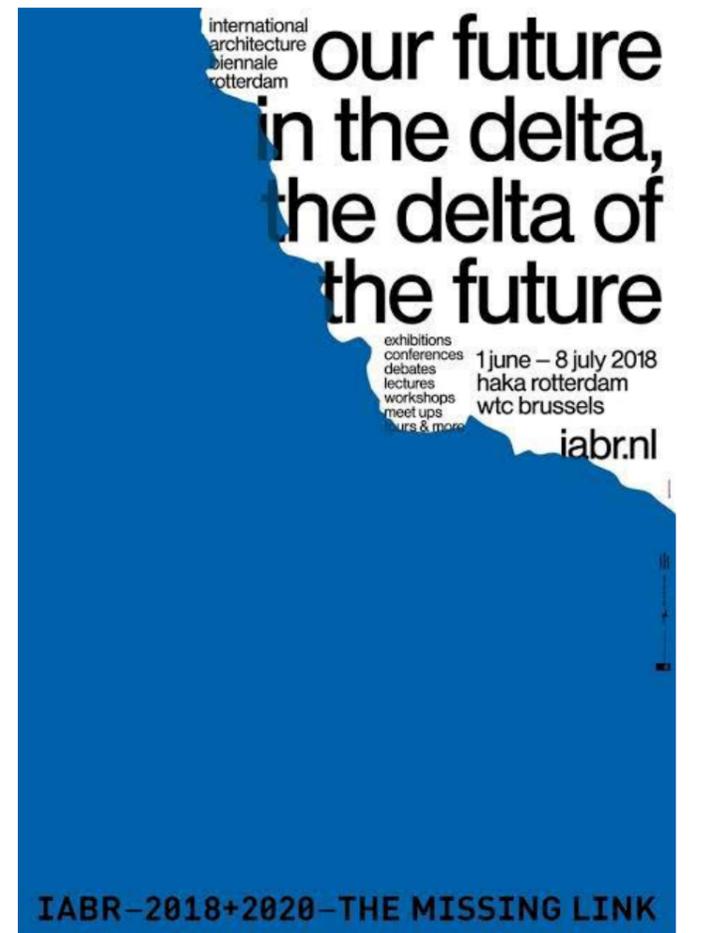
An example intervention is a pair of bridges installed at the high-water channel at Veessen-Wapenveld that frame a by-pass for the river IJssel. If river water rises to a critical level, the inlet bridge at the south is opened in sequence by an integrated hydraulic engineering system of sixty lock gates that allow water to flood the polder landscape stretching eight kilometres to the outlet bridge at the north.

Architects and landscape architects at ZUS⁹² worked together with engineers to create an integrated design for the two bridges and eleven smaller bridges that make up the project. Outside the rare occasion the river requires a diversion zone where its water can flood, the area between the bridges is preserved as an agricultural grazing landscape and refuge for ecological diversity.

On what earth are You Thinking? a fragile affair between architecture and ecology



IABR-2018+2020-THE MISSING LINK

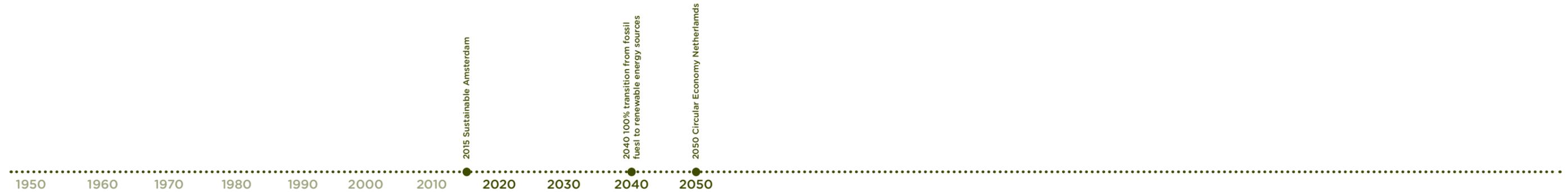


IABR-2018+2020-THE MISSING LINK

5.0 Amsterdam

5.1 Westerpark

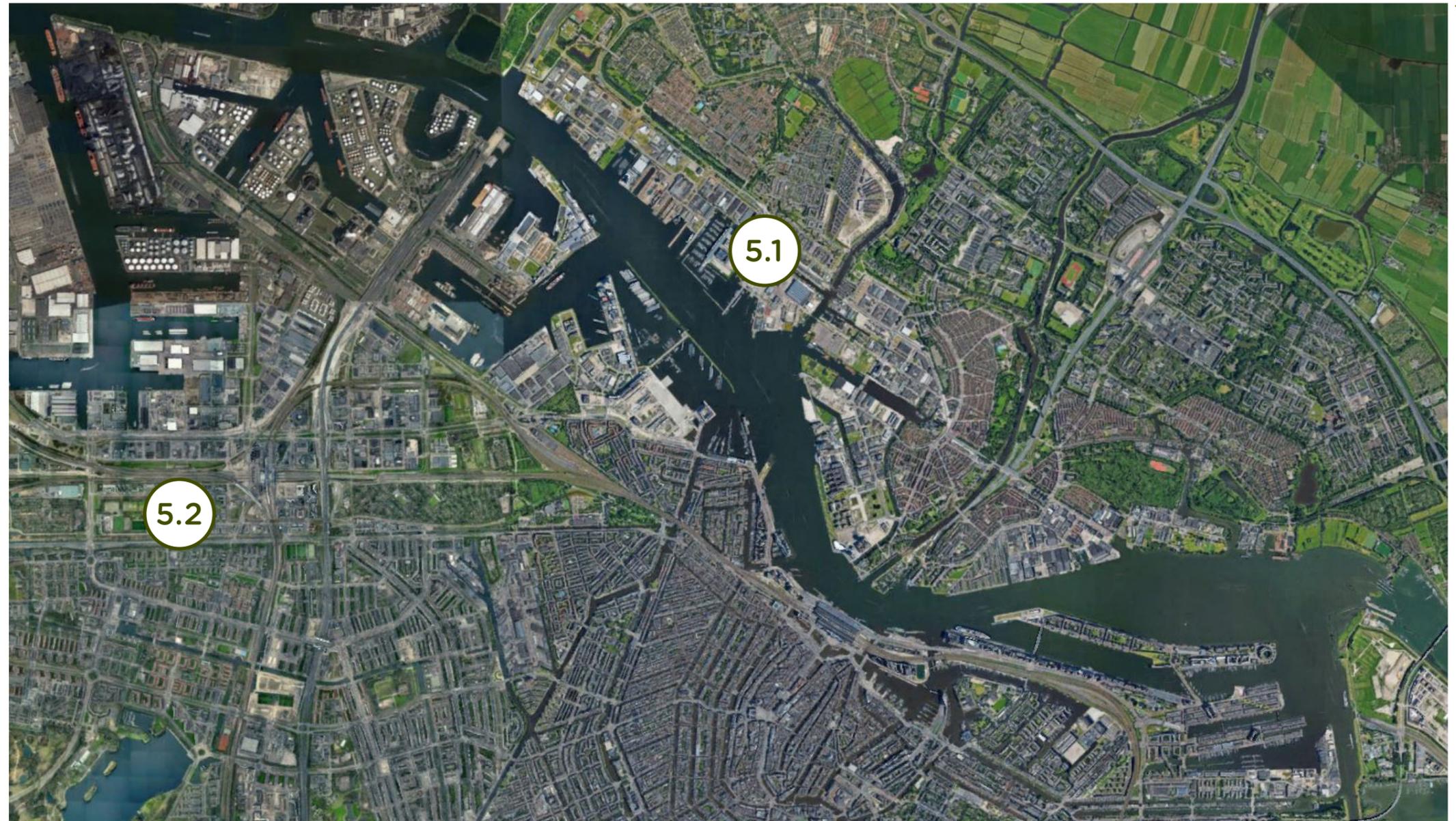
5.2 De Ceuvel



74 The etymology of Amsterdam seeds from a dam formed around the river Amstel following the floods of 1170 and 1173. Amsterdam's climate is oceanic with moderately warm summers and occasional frost in spells of easterly or north-easterly winds from the inner European continent. Amsterdam was granted city rights in the early 1300s and from then on, flourished through trade. Through the sixteenth century, the Dutch rebelled against the Spanish for imposition of new taxes and the religious persecution of protestants by the inquisition. The Dutch revolt escalated into the Eighty Years War, fought in seventeen provinces across BeNeLux (Belgium, the Netherlands and Luxembourg) that eventually led to its independence. Known for its religious tolerance, the Dutch Republic became a refuge for Iberian Jews, French and merchants from the Flanders low countries.

In the Golden Age of the seventeenth century, Amsterdam became the wealthiest city in the western world. Its merchants owned the largest share in both the Dutch East and West India Companies who acquired overseas possessions turned colonies. The Dutch East India Company's Amsterdam office also became the world's first stock exchange. The influx of Flemish printers and the city's intellectual tolerance made Amsterdam a centre for the European free press, where published material is considered a right to be exercised freely.

Over a hundred thousand people were deported from the Netherlands to Nazi concentration camps through World War Two, more than half of which were living in Amsterdam. In response, the Dutch communist party arranged a three hundred thousand strong strike against the raids. As of 2012, the racial and ethnic diversity of Amsterdam was 49.5% Dutch and 50.5% of foreign ancestry from almost two hundred nationalities. It is one of the most diverse cities in the world. As the Hague holds the seat of government, Amsterdam serves as the titular capital and most populous City of the Netherlands with almost two hundred and fifty million residents in its metropolitan area.



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this page (top): Space & Matter have transformed the former bridge control rooms into studio hotel rooms on Amsterdam's canals
this page (bottom): plants outside Amsterdam houses
opposite (top): smoke rising from the industrial precinct of the Wooddocks west of the historic centre
opposite (bottom): shared residential courtyard in Amsterdam's east



The seventeenth century canals of Amsterdam and the defence line of Amsterdam constructed in the nineteenth and twentieth centuries are collectively protected as a UNESCO World Heritage Site.

The Amsterdam city centre has become a mass-tourist attraction in the twenty-first century, with the number of annual visitors rising from ten to seventeen million in only three years between 2012 and 2015. Protected from increased density, the historic centre of Amsterdam is overwhelmed with traffic and increasing unaffordability.

Planning Promises

Biodiversity, measured by the population of plant and animal species to the size of land, has diminished in the Netherlands to fifteen percent of its original measurement. A quarter of that loss occurred in the twentieth century alone. In comparison, Europe has retained almost half of its original biodiversity. Causes of loss⁹³ include change of land use, fragmentation of ecosystems as a result of development and homogenisation where diversity of species gives way to an increase in dominant, opportunistic species.

Sustainable Amsterdam⁹⁴, published in 2015 by the Municipal Council of Amsterdam, outlines the city's agenda through five transition pathways; renewable energy, clear air, a circular economy, a climate-resilient city and a sustainable municipality. The Netherlands will transition to a fifty-percent circular economy by 2030 and an entirely circular economy by 2050. At the



scale of Amsterdam, the transition will focus on separate waste collection and recycling systems, separating sixty-five percent of domestic waste for reuse by 2020 already.

By 2020 Amsterdam aims to use twenty percent less energy than 2013 by upgrading existing structures, reducing consumption of energy by corporate and social real estate and encouraging energy neutral construction. In the same timeframe, the City will generate twenty percent more energy per inhabitant by constructing wind turbines and facilitating growth and accessibility of solar energy systems. By 2040, Amsterdam will reach a threshold of 1,000MW of solar power, over two-thirds of the consumption to power 450,000 homes.

A full transition from fossil fuel energy derived from coal, oil and gas to renewables will lower carbon dioxide emissions in 2040 by seventy-five percent from 1990. From 2025, motorised traffic should be as clean or emission free as possible, allowing every citizen enough time to transition and adjust accordingly.

Amsterdam has a pragmatic approach to the question of how the current generation can begin working towards those future targets in the present. This realism is achieved with reciprocal cause and effect strategies



such as reducing the city's energy bill to boost the economy, reducing driven kilometres with smarter logistics for public transport that will clean air and improve efficiency as well as building rooftop gardens wherever possible in preparation for both torrential rainfall and food supply.

In its move toward climate neutrality, the municipality will monitor the implementation of its agenda and eliminate

obstructive regulations by setting standards and intervening if financial parties fail to fund promising initiatives or innovations from the top down. From the bottom up, if Amsterdam citizens and organisations cluster to educate themselves or implement positive change the municipality will honour initiatives through funding, access to resources and support and will set a clear lower limit to all its strategies to ensure the transition can generate interim results.

Funding of various components of the plan will be addressed on a case-by-case basis, though the City of Amsterdam has established a revolving Energy Fund that combines all resources and eliminates confusion of different old and new funds, current investments and allocated funding. Brought together, the Energy Fund will clarify how various resources can cross-pollinate each other while simplifying the municipalities financial "landscape".

5.1 Westerpark

Cultuurpark Westergasfabriek is a landscape redevelopment project of a former brownfield site of over one hundred thousand square metres to the north-west of central Amsterdam. The park runs east-west, framing the historic city centre to the south and Spandaammerburt neighbourhood to the north. Considering historic protection of the city centre, the Houthaven⁹⁵ (wood docks) area north-west of the City has become a prime area for redevelopment and is under construction as the city's first climate neutral district. Almost three thousand residences are being built in the area, of which twenty percent will be social housing along with space for education, commercial, medical, hospitality and recreation.

Westerpark was the first municipal park of Amsterdam, originally named Westerplantsoen or Western Garden, constructed in 1845 as a breath of fresh air to a working-class population living among the smog of industrial pollution. The original park was torn down in 1891 for the relocation of the western canal and the neighbourhood Westerpark came to be in its current location behind the gas factory. The British Imperial Continental Gas Association began operation on the site in 1885.

The gas was extracted on site from coal and was used for street lighting. Rising gas prices led the City of Amsterdam to take over the operation and expansion of the site in 1898. The large Gasholder was built in 1902 and produced gas that could be easily transported via the adjacent rail line.

Discovery of natural gas in the North Sea rendered the factory obsolete and production permanently stopped in 1967. Its structures stood empty or were

used for storage or occupied by squatters. Aesthetic values matured over time and caused the collection of industrial brick structures that once served the gas factory to be considered industrial monuments to the city's history. In 1981 the site was rezoned as recreation space and in 1996 five design firms were invited to envision the future programming of its open space.

Having operated as a gasworks and endured the devastating pollution of the industrial revolution as well as the economic rebuilding following World War Two, the site of the competition stood highly contaminated and the brief for its reimagination called for a proposal that could ecologically heal itself over time. Polluted soil had to be responded to on site to avoid displacing the problem to other areas within or outside the City.

What Happens at Westerpark?

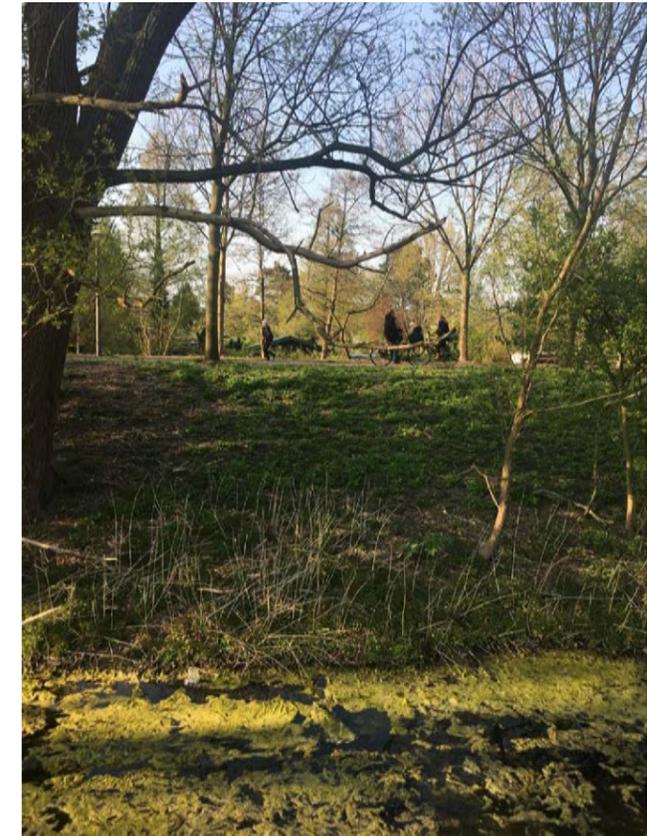
The gasworks reopened in 2003 as the Culture Park Westergasfabriek following decades of sitting empty. Most of the thirteen buildings on site were originally designed by the Jewish architect Isaan Gosschalk in the Dutch Neo-Renaissance style popular in the Netherlands from the end of the nineteenth to the start of the twentieth centuries. The original buildings that have been maintained on site are designated as national monuments.

On site now are a variety of creative studios and hospitality venues including the Ketelhuis Cinema with three screening rooms, restaurant, a wine lab and tasting centre, a brewery with live music, bakery, espresso bar and several small bars. In the plaza between buildings a market is held on the first Sunday of every month and for large summer music festivals like Amsterdam Dance Event (ADE), Westerpark temporarily transforms its gas holders into a collection of concert halls and its landscapes into outdoor stages.

The winning design by Gustafson Porter and Bowman, realised in 2004, centres on an axial promenade that transitions from a more formal entrance plaza by the town hall through the smaller studio buildings and marketplace to a more dissolved natural setting as it travels westward and eventually connects with a grid of hundreds of allotment parks 'Tuinpark Sloterdijkermeer'.

These were established as an area for workers to grow vegetables in the food shortage of the Great Depression on reclaimed swampland. Over time as food sourcing has industrialised and commercialised through prosperity of the last half of the twentieth century, the need for individuals to provide their own produce has given way to markets, supermarkets and small providers. The allotment gardens have transitioned from urban farming plots to ornamental garden plots with small cottages where members live in the summer, between April and October.

Peeling off the straight central axis that hugs Haarlemmerweg to the southern edge of the site are winding and curving pathways that take visitors through an expanding and contracting adventure of intimate and open landscapes.



this page: park goes stroll the northern ridge of Westerpark
opposite (top): cyclists passing by a lowered wetland
opposite (bottom): the original Gasholder has been transformed into an event space with soaring ceilings

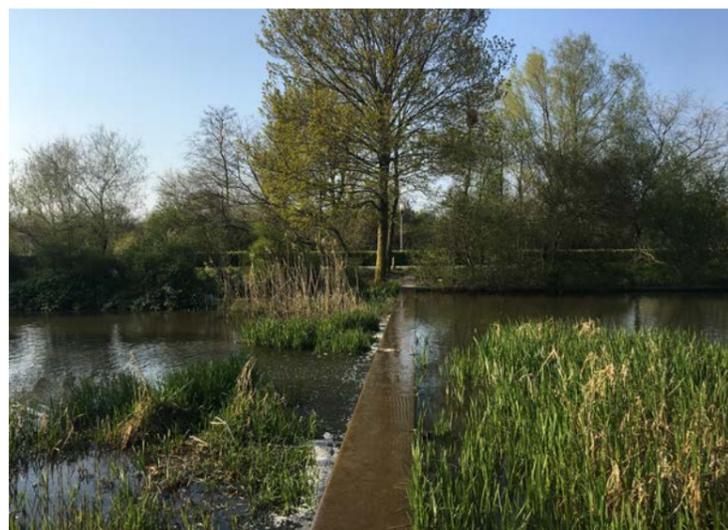


Urban Ecology at Westerpark

Changement⁹⁶ was the winning proposal by Kathryn Gustafson in collaboration with Francine Houben of Mecanoo, that caused her to open an office in London with Neil Porter and translate the schematic concept into a detailed design and delivery. The concept responded to the masterplan with an offering of diverse spatial and temporal experiences. The brief called for a recreational park for locals, a strengthening of natural environmental qualities and the introduction of a two thousand square metre open air events area.

The central events field gently slopes to a stone-lined lake bordering its northern edge that can be drained if required for mass gatherings. A dijk frames the northern border that acts as an acoustic barrier to the railway line north of Westerpark and directs excess rainwater down into the lake, retaining a high access path along its ridge for cyclists and pedestrians to traverse the park while also preventing flooding.

Changement not only describes the variety of landscape typologies and scales one experiences as they move through the park today, but a living illustration of development in humans use and engineering of urban gardens. The east end of the park reflects a more formal traditional English garden of a manicured lawn and a careful matrix of geometric plantings. The central area with the events field recalls the post-war attitude towards landscape as a site for play and freedom, leisure and recreation. The north-west polder takes on the pure and natural approach to landscape of recent decades where ecological zones are designated and left alone whereas the west end of the park is designed to dissolve the nature-culture divide by welcoming human agents into the landscape as members or stewards of urban ecology.



In response to the sites history and contamination, Gustafson Porter & Bowman proposed a careful cut and fill balance that retained the ground level around the existing gas factory structures and introduced new soil in an undulating terrain beyond. The landscape surrounding the basement structures of the gasholders have been filled with the worst soil and capped to become a contemplative water-lily aquatic landscape and verdant garden over which timber walkways and terraces connect visitors onwards to the parks other gardens and open spaces. The design welcomes the site's history as inherent to its design and integrates its repair as an ongoing element of its function.

Westerpark: a Living Structure

The diversity of landscaped zones in the park combines native plants and introduced varieties. Wetland systems that travel across the park cinch into narrow willowed marshy tributaries that create a home for ducklings and other waterbirds and then widen into lakes and ponds around the sites social spaces like the restaurant and bar terraces and the events field. In these moments, a network of elevated timber bridges with benches provide access for visitors to explore the wetlands.

The ground is left available for reeds and water grasses to grow unperturbed. Centenarian trees and willows raking the ground frame the ponds. New *Salix babylonica* and *alba sistris* skirt the edge of the remaining basement structures of the gasholders which have been filled with the worst pollution and capped to become a contemplative water-lily pool and verdant aquatic garden. Large existing trees from the original park are joined by bands of woodland plants on a mound that runs the length of the park.

This case study is less architectural than the others profiled as its constructed environments are largely those of outdoor landscape settings for both people and other species though its ability to read the layered history of its site is remarkable. Amsterdam landscape and interior designer Petra Blaisse of Inside Outside studio considers the mentality of Dutch design to reflect a national attitude towards the fact that the water, muddy and sandy foundations of the country have always offered an invitation to a culture and society that needed to work hard to invent and express itself. In this way, the down-to-earth sobriety that has had to take seriously the biological context of earth material is injected with an attitude of colour, humour and playfulness towards its outputs.

I had an opportunity to interview Lonny van Ryswyck, one half of the Dutch design duo Atelier NL⁹⁷ who explained with a delicate touch her perception of design working together which nature in a way that frames how the two have always been entwined. The studio performs simple acts in the process of designing objects and exhibitions that over time, reveal the potential and values of materials. 'To see the world in a grain of sand' is an ongoing catalogue of international sand samples that have been collected and mailed to the studio then transformed into glass. It is a project that shatters preconceptions on how properties of manufactured glass have come to be the accepted norm.



this page (top): timber footbridge over the central canal
this page (bottom): blurred vegetation between the soil and water's edge
opposite (top): tree lined pathway in Westerpark
opposite (bottom): low and high transitions of water in Westerpark

5.2. De Ceuvel



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Amsterdam's first circular office park, De Ceuvel⁹⁸ opened in 2014 on the northern side of the river IJ. In 1919 the site was purchased and the building of the shipyard Volharding commenced.

The site changed hands in the fifties and two trees were planted that still stand today. In 2000 the shipyard ended operation after eighty years and the buildings on site were demolished. The site stood abandoned for ten years and when a planned urban development came to a halt in 2012, an opportunity for alternative development of the site arose. This led a group of creatives searching for space to work, together with the Amsterdam architecture practice Space & Matter and Marjolein Smeele, to formulate a proposal for a regenerative work park on the former shipyard.

The City of Amsterdam awarded the tender for De Ceuvel as one of four plots of land to be given to pioneering initiatives that privileged sustainability and circular urban development. This led to the development of a masterplan to transform the site into Amsterdam's first circular office park on a ten-year lease. The ambitious plan required input from experts in urbanism, architecture, landscape, economy and sustainability. Within a limited budget, the multidisciplinary team focussed on design strategies that reused and made valuable as much existing material and resources as possible.

Seventeen houseboats were acquired for almost nothing as it was more convenient for their former residents to gift
Byera Hadley Travelling Scholarships Journal Series

the boats than arrange their removal. The boats were transported to NDSM wharf where tenants worked on the renovations themselves, stripping walls, raising roofs and lowering floors, before they were raised on site by

crane at De Ceuvel and retrofitted as offices, ateliers and creative workshops with a winding bamboo walkway connecting the spaces and its occupants to others in the precinct. The circulation network between boats is deliberately elevated, reserving the ground to a careful selection of plants that filter pollutants leftover from the sites industrial memory.

De Ceuvel dissolves the typical urban office typology where corridors and vertical lift or stair shafts that connect office and studio spaces are in a securitised 'shared' zone that is not always publicly accessible or available as planted space. It is a testing ground to experiment with ideas, systems and strategies of how material, energy and waste can be optimised and made circular. Volunteers and tenants assisted in executing the base design and build and the site's evolution continues through workshops advertised on social media and open to the public to improve infrastructure.

What Happens at De Ceuvel?

In one masterplan, three environments are created at various levels relative to ground. The uppermost level is reserved for humans at work in the houseboats, collaborating in the workshop spaces and having a meal or a beer in the cafe de Ceuvel. The archipelago of boats is interconnected by a winding boardwalk raised ninety centimetres off the polluted ground. Space & Matter



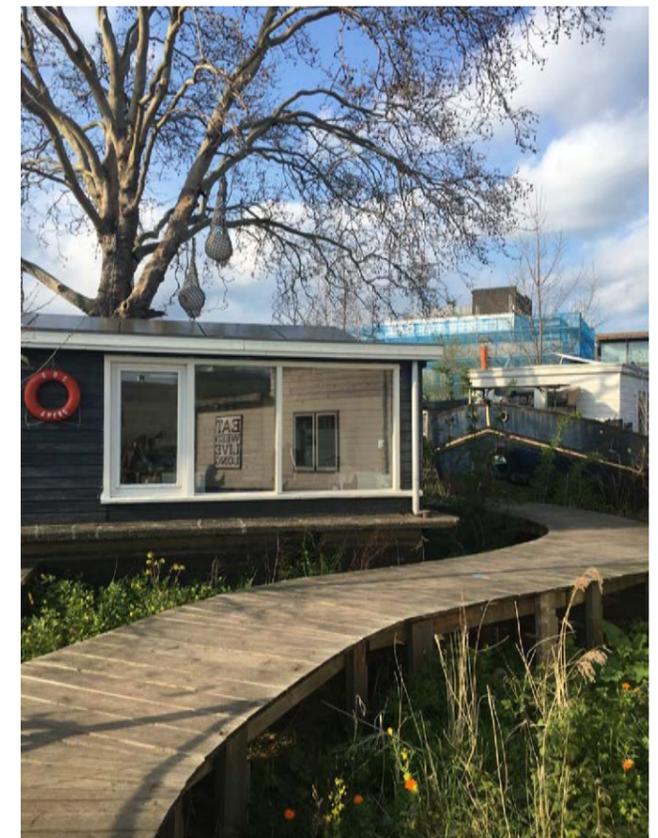
83

this page (top): aerial image of De Ceuvel, source: we the city
this page (bottom) and opposite: winding elevated bridge provides access to the transformed houseboats while plants are left to perform phytoremediation on the ground

architects played a significant role in setting this datum by driving the initial master plan as well as working with the tenants on the transformation of the boats to a collective area of twelve thousand square metres of workspace. The tenants include; shared workspace, architects, interior architects, artists, copywriters, journalists, communication agencies, public space specialists, place-makers, art directors, photographers, advertising agencies, filmmakers, events and consultants in sustainability and social innovation.

The boats have been upgraded to the highest level of efficiency and quality possible, fitted with composting toilets which empty into a central composter in the tech Hub. Solar panels installed on the office boats cover most of the electricity demand and each boat is equipped with a heat pump and air-to-air heat exchange ventilation system. Wastewater from kitchen sinks is processed in helophyte filtration systems which are simple constructions composed of various layers of natural mediums including soil, stone, sand and plants.

Renovation of the houseboats and most elements of the project have been made from reused or refurbished materials at the cooperative workshop on site. Small boats rescued from Amsterdam's canals have been halved and turned into seats along the boardwalk to rest on. The work-shop is an indoor theatre and stage accessible to everyone that has hosted music evenings with young talent, theatre with experienced actors, film screenings with the Eye institute, exhibitions of visual art and parties. The Crossboat provides a multifunctional space that can be used for meetings, courses, lessons, presentations, as a cinema or co-working space and as such has been designed to accommodate various configurations.



Urban Ecology at De Ceuvel

The second layer of the datum lies in the ground, where the boats occupy less area than a traditional building slab as their hulls diminish closer to the point of contact with earth. It is on this layer Delva Landscape architects designed an environment that could cleanse the polluted brownfield. Researchers from the University of Ghent worked with Delva on a phytoremediation plan uses a selected combination of plants to purify metal particles, pesticides, solvents and oils present in the heavily contaminated soil.

Normally polluted soil is mixed with clean soil until the level of pollution is deemed acceptable, which only dilutes the problem. Soil samples are regularly examined at De Ceuvel to monitor the process. As self-sufficient elements, the boats are designed to be able to leave the site without a trace when the temporary ten-year lease expires and the land will be left more valuable and

biodiverse. This thinking of site response eradicates the need for demolition and of material wasted with the dismantling of construction.

The third and final layer of the datum does not occur on a single level or in a fixed studio but travels between all the spaces in flowing systems that feed water and energy throughout the precinct. Vegetables and herbs served in the café are grown in a greenhouse with an aquaponics system. The tech boat contains a fish tank for the aquaponic system, a struvite reactor and a tumbling composter. Ammonium from the fish tank is filtered by plant roots and broken down to nitrites that feed growing vegetables. Water filtered by the plants goes back down to the fish tank, microbes and worms convert the fish waste into fertiliser and then the nutrient rich water is returned in the system to feed the plants.

Organic waste from the kitchen is shredded, stored and mixed again in a tank on the Biogas boat. This boat is dedicated to reducing waste by contributing to circular systems. Shredded organic waste is transformed into biogas with the biodigester which is used again to cook in the kitchen. Compost broken down provides a rich source of nutrients for plants and insects as fertiliser and a bio-fermentation plant converts biomass into energy. Workshops are provided to all occupants and visitors to increase awareness and provide an education platform that demonstrates circular systems in action. Potable water is provided by city water, as the proposal to capture rainwater to make drinking water was rejected by the City of Amsterdam because licensing the community as a drinking water provider proved complex and costly. The ateliers are not connected to the municipal sewer system though the commercial spaces are.

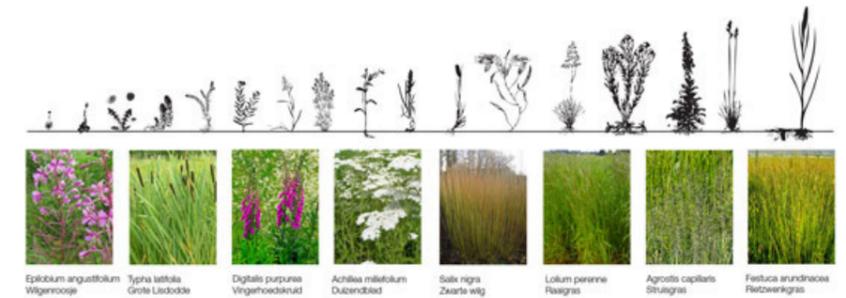
De Ceuvel: A Living Structure

In regard to financing, boats are either rented by individual companies while others are shared by multiple and together these tenants have ownership of De Ceuvel through membership. Members are rewarded for saving energy with a cryptocurrency called 'Jouliette' which can be exchanged at the cafe for drinks. At a cost of only five thousand euros for materials, the return on investment for clean technologies installed was estimated to be less than three years.

*"The project was funded by the city through a 250,000-euro, or \$313,000, start-up grant and a further 200,000 euro bank loan that it guaranteed. Those funds covered materials, plants and some of the professional services required to make the project a reality. Volunteers and development partners invested hundreds of hours of work which ultimately lowered the cost. Tenants rent the boats for approximately 65 euro per square meter of workspace per year — a song in comparison with commercially available art spaces which, in Amsterdam, can fetch that much each month. The proceeds, Mr. Glasl said, are being used to pay off the guaranteed loan over the next nine years."*⁹⁹

Cafe De Ceuvel and the Hotel Asile Flottant are independent companies within association De Ceuvel. The cafe is constructed from eighty-year old bollards from the port of Amsterdam and a lifeguard beach pavilion from Scheeveningen. Hotel Asile Flottant¹⁰⁰ is a collection of six boats each with a unique history and character that have offered floating accommodation beside the office park of De Ceuvel since 2016.

Dutch studio Metabolic¹⁰¹ worked with partners, entrepreneurs and volunteers on the sustainability of the masterplan to transform the area. Entwined with the architectural expertise of Space & Matter and the landscape expertise of Delva, Metabolic recommended installation of low-cost clean technologies that would make the development's resource management as circular as possible. In line with the circular economy vision for the entire nation, the project primarily offers space to its everyday users but in a broader sense a place for circular economy education. The Metabolic Lab on site is a facility for events, meetings, workshops and training that was built by the consulting and venture company and provides a platform for ideas and systems to be discussed, interacted with and improved. The lab can host twenty people for a discussion or meeting and up to thirty-five for a film screening or lecture and over thirty-five thousand people visit the lab annually.



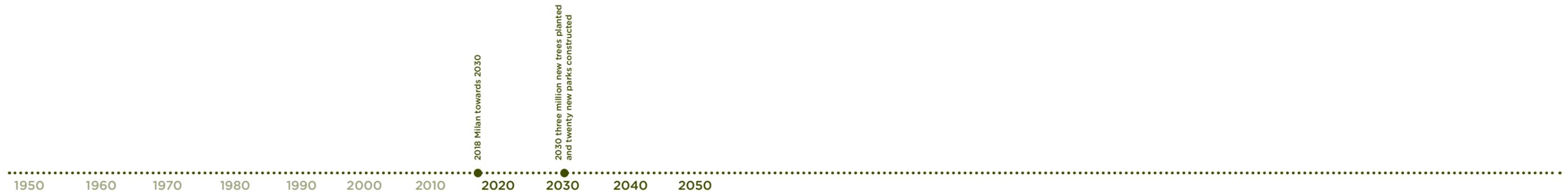
this page (top): De Ceuvel cafe in full swing in summer, source: Lettuce take a trip
this page (bottom): office boat hidden in the verdant ground plantings
opposite (top): diagram of phytoremediating plant species, Delva landscape architects
opposite: winding pathway to access work park spaces



6.0 Milan

6.1 Bosco Verticale

6.2 Broken Nature



86 I will present this city through a pattern in Milanese modern history in which forms of radical thought emerge beyond the resistances from which they arose. Fast forwarding ancient history, Milan became the power centre of northern Italy at the point of national political unity with its railway construction gradually granting commercial dominance between the late nineteenth and early twentieth centuries.

Milan lies in the north-western portion of the Po Valley between the Po River to the South and the Alps to the north in a humid, subtropical climate. The Manifesto of Futurism⁹⁸ written by Filippo Tommaso Marinetti was published on the front page of the French newspaper Le Figaro on February 20, 1909.

It carried with it a burning desire to abandon the past and embrace the future in a new aesthetic language formulated on war, industry and the machine. Marinetti was only one of an entire group of Futurists whose collective oeuvre amassed drawings, photographs, films, performances, painting, sculptures, manifestos, leaflets, exhibitions, publications and poetry that all attuned to the beauty of accelerated speed inherent in the machine.

“Let us leave good sense behind like a hideous husk and let us hurl ourselves, like fruit spiced with pride, into the immense mouth and breast of the world! Let us feed the unknown, not from despair, but simply to enrich the unfathomable reservoirs of the Absurd!” - Marinetti, 1909¹⁰²

The first organisation by the Italian Fasci of Combat led by Benito Mussolini was held in a baroque palace of the city centre Piazza San Sepolcro in 1919. Commonly known as “blackshirts”, the voluntary militia for national security in Italy arose from the parliamentary wing of the National Fascist Party and after 1923 became an all-volunteer militia of Italian citizens under fascist rule who wore black uniforms reminiscent of Italy’s elite troops in World War I.



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Milan became fragmented by allied bombings during the second world war and when Italy surrendered and the fascist regime collapsed in 1943, German forces occupied the majority of northern Italy for two years. As the war came to a close, the resistance that had developed during this period seized control of Milan and executed Mussolini and the members of his government by hanging in Piazzale Loreto.

It is impossible to table Italian innovation in architecture without pausing between the sixties and seventies in the post-war period where radical propositions for the profession to create discourse about a hypothetical future was in its prime. As Francisco Diaz put the situation quite frankly in a 2019 symposium at the University of Technology, Sydney, architects do not 'make' buildings but rather documentation, discourse and public communication around objects. Italian expression of opinion curated manner in that transcends public opinion and forms a movement is exemplified in the work of 'Superstudio'¹⁰³. Active between 1966 and 1978, the collective of around twenty members used everything but buildings to propose an alternative to modern life on earth. Reaching beyond Italy to the world, their seminal works for hypothetical futures include the 1969 'Continuous monument: an architectural model for total urbanization' and a series of films in the early 1970s that aimed to raise awareness of the harmful impact of construction on the natural environment.

In the eighties, Milanese fashion houses Armani, Dolce and Gabbana and Versace placed the city at the magnetic centre of the international design world which elevated the economy through international tourism. The stock exchange increased its capitalisation five times over. But the nineties were scarred by a political scandal in which city officials were tried for corruption. Milan today is the wealthiest non-capital European City and the third largest European economy after London and Paris but the fastest growing of the three. One of its most magnetic attractions is the "exposition" which takes form in; Milan Fashion Week, the Milan furniture fair, world expositions and the Milano Triennale.

Planning Promises

Milan 2030¹⁰⁴ is an ambitious plan that stands to be proven, for it is yet to be publicly disseminated though fragments of its intentions have been released and expanded on through interview and various online publications. The plan centres around five strategies; connecting Milan, the metropolitan area and the world, an attractive and inclusive City of opportunity, a green, liveable and resilient City, one City of eighty-eight neighbourhoods and a City that regenerates. The third strategy is most relevant to this study.

By the forecasted year of the plan's implementation, Milan expects to welcome twelve thousand additional residents over eighty-five and fifty thousand between the age of fourteen and thirty-four, the latter moving to the city at a formative age for learning and professional training. Pierfrancesco Maran, the city councillor responsible for town planning, parks and gardens and agriculture in the municipality of Milan, prioritises three elements on which the future plan for the city hinges; sustainability, parkland and quality.

The city has committed to deliver twenty new parks with a combined area of over ten thousand square metres that are intended to form an interconnected network of biodiversity. These spaces are planned in such a way to connect two larger parks, the Parco Nord Milano and the Parco Agricola Sud, through a network of City parks and corridors ranging public and private land parcels of all scales. Milan towards 2030 has encouraged the transformation of brownfield sites like parking lots and decommissioned industry and transport sites into constructed ecologies.

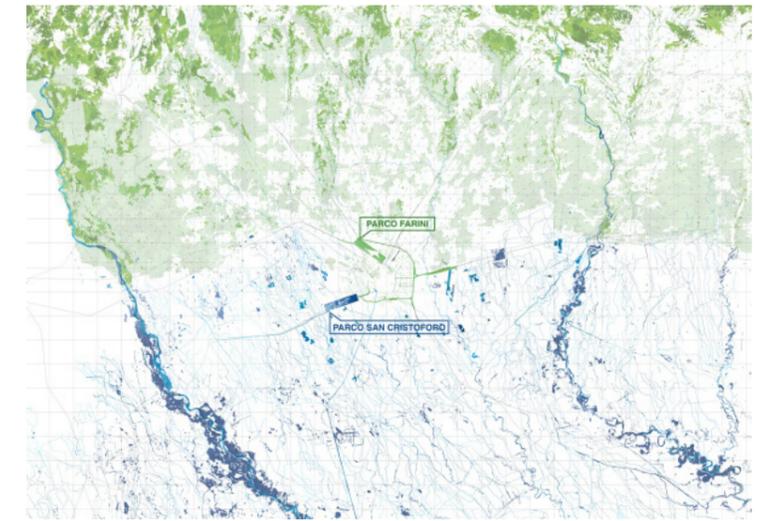
One example of such a project is the winning proposal 'Climate Agents'¹⁰⁵ for the Concorso Farini competition to redevelop two abandoned railyards in Milan won by OMA and Laboratorio Permanente. One of the sites is designated a green zone of a spacious park to cool and purify air and the other site a blue zone with a large basin to filter groundwater and welcome both humans and animals in an urban aquatic ecosystem.

Milan has committed to planting three million trees by 2030¹⁰⁶, or twenty-five thousand every year for the next twelve years. officials estimate increasing trees by thirty percent will reduce temperatures in the City by two degrees and absorb an additional five million tonnes of carbon dioxide annually, which is four-fifths of that currently produced by Milan.

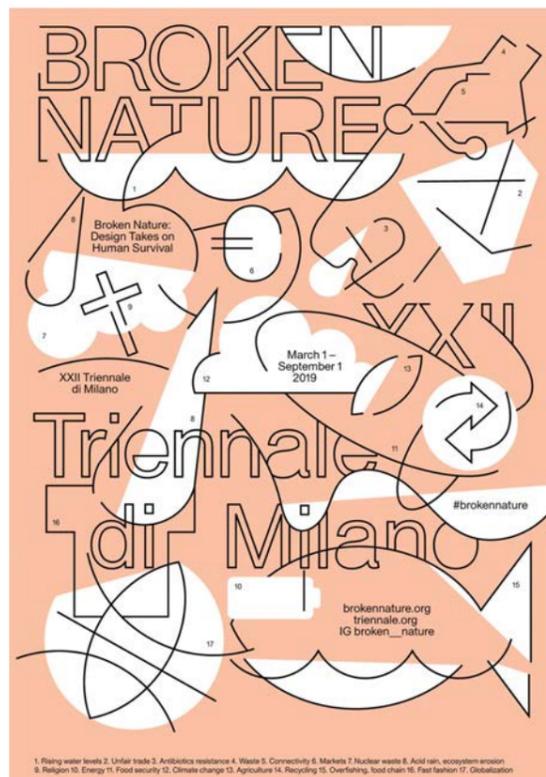
Planning laws that will affect the architecture discipline include a demand to reduce soil consumption by four percent through building regulation, demanding a minimum of three square metres of agriculture land on every project as well as adapted rules for new and existing buildings to minimise energy consumption and reduce carbon footprint and re-naturalise and maximise drainage surface .

As Milan is statistically divided into the historic City centre and the city proper, those areas that lie peripheral to the centre where rapid growth and transformation are taking place are where the City have chosen to dedicate half of its funding. Measures taken include halving the charges to change the use of a site in those locations and a penalty of a significant reduction in the value of the site if the proposed development does not renovate or demolish disused buildings located on it.

This research presents two projects that have more in common that meets the eye, the widely published vertical forests designed by Stefano Boeri in the peripheral district of Porto Nuova and the XXII edition of the Triennale di Milano 'Broken Nature'¹⁰⁷. The Italian contributed to the latter in the form of a public platform for storytelling, discussion and research to experiment with the future of Milan on issues spanning; development, urban forestation, suburban renewal and major events. The chairman of the Triennale turns out to be none other than Boeri himself who has taught at the Berlage in Delft, Strelka Institute in Moscow, who is director of the Future City Lab at Tongji University in Shanghai, has been the director of Domus magazine and the councillor for culture of Milan all while heading his own studio since the late nineties.



this page (top): map of winning proposal for Parco Farini, connecting Milan's major nature reserves
this page (bottom): plants growing through the porous path at Fondazione Prada
opposite (top): public gardens outside the Sforzesco Castle, built in the 15th century
opposite (bottom): poster for Milan Triennale Broken Nature 2019



6.1 Bosco Verticale



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this page (both): Parco Biblioteca Degli Alberi - Library of Trees Park
opposite (top): Inside Outside design for the interior carpets and exterior gardens of Seattle Public Library, source: archello
opposite (bottom): Bosco Verticale by Stefano Boeri Architects



Porto Nuova¹⁰⁸ translates to 'new door' and derives from the preserved Neoclassical gate built in 1810 on the site. It is Europe's wealthiest district of the city with a GDP of four hundred billion euro and is set to welcome several European Union agencies from the United Kingdom in the fallout of Brexit. It is the main engine of the global invention of "polypropylene" or plastic by Giulia Natta during the 1950s that was popularised by global manufacturing companies. The area lies directly north-east of Milan's historic centre and has reunited the Garibaldi, Varesine and Isola neighbourhoods in a redevelopment of almost three hundred thousand square metres of deteriorating land. The entire district has been designed in full compliance with the LEED certification and integrates passive energy solutions including green roofs and porous drainage materials.

It is the district of Milan in which the Bosco verticale residential towers completed in 2014 by Stefano Boeri hover over the 'Biblioteca degli Alberi'¹⁰⁹ (Library of Trees park) completed by Dutch studio Inside Outside under directorship of Petra Blaisse. The park project was won through a design competition in 2006 by Blaisse in collaboration with plantsmith Piet Oudolf and others. The concept is a contemporary evolution of a botanic garden.

Axes directed from surrounding streets and blocks and buildings are drawn into the park as pathways that generate an irregular grid of connections and delineate plots for diverse microenvironments. Overlaid on these vector paths are a dozen circular geometries of varying scales that take the form of forests. Hundreds of trees from nineteen species and thousands of shrub and ground cover species form a living carpet that stretches over three and half thousand square metres and restores the urban plot to a natural setting after being an impervious surface for decades.



Inside Outside studio balance a rare scale of commissions between the interior artefact such as carpet and curtain right up to the urban landscape plan. In Seattle Public Library, the studio were responsible for the external landscaping as well as the interior fitout, in which the two seamlessly blended in a design where glass curtain walls divide what appear to be continuous landscapes but are in fact graphic landscapes rendered in carpet on the interior that seem to flow beneath the glass to carefully selected plant schemes for the New York environment on the exterior. As one traverses the building, the natural colours move from green foliage to warmer colours as the connection between the visitor and planted ground grows.

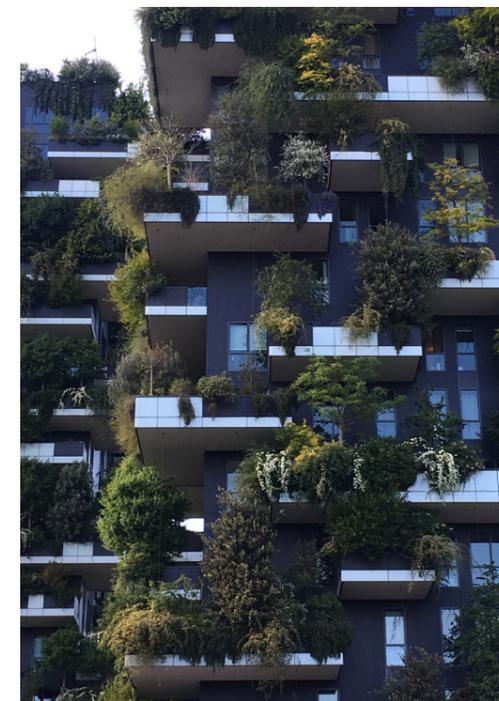
What happens at Bosco Verticale?

At the south-west corner of the Library of trees in Porto Nuova is a vertical forest designed by the Milanese architect, academic and researcher Stefano Boeri and his studio team of around eighty. Historic developments that have influenced the urban forest projects are; Friedensreich Hundertwasser's planted interventions in Milan for the 1973 Triennale that declared architecture must leave more space to nature, the forty-five metre Torre Guinigi in Lucca Tuscany atop which tall holm oaks grow. Within a brief for four hundred condominium units, Bosco verticale challenged itself to generate a forest of two hectares on an urban plot of only two thousand square metres. In a manoeuvre

that recalls that familiar scene in Inception where the vast expanse of landscape tilts vertically towards the viewer, the towers scatter a canopy of trees three to nine metres tall across the private balconies of each apartment. For every human, the project aims to sustain a place for four birds and butterflies, two trees, eight shrubs and twenty-two plants. The vertical curtain of vegetation is planted according to its aspect, protecting from direct radiation in summer and allowing winter light through deciduous trees in winter, protecting residents from strong winds, releasing humidity, capturing small toxic particles, producing oxygen and reducing acoustic pollution.

"It is essential to create a better natural environment while building, and we have to stop the mineralisation of urban surfaces.

We need to multiply the vegetable and organic surfaces, horizontally and vertically, knowing that in the future we will be obliged to build high-rises not only out of necessity, to stop the consumption of natural and agricultural soil, but also because of the cost." - Ernst, Hortitecture¹¹⁰



Boeri, Jacques Herzog and Ricky Burdette developed a concept proposal together for the Expo 2015 in Milan that dealt with the diet of the world's population while confronting the term sustainability as rhetoric that avoids the real state of things. In partnership with the Slow Food Association, the expo imagined a planetary garden where countries were invited to demonstrate local methods for turning agricultural product into food through technology.



Urban Ecology in the Bosco Verticale

Since its completion in Milan in 2014, the vertical forest has given rise to a new typology that has itself become a brand of commission for Stefano Boeri Architetti with offspring in Cities all over the world. In Cairo in Egypt, the studio were commissioned in 2019 by MISR Italia Properties to design three green architectures¹¹ for the New Capital in the South east area of the city, triplet cubes thirty metres high that host three hundred and fifty trees and over fourteen thousand shrubs and perennials of more than a hundred species over a total landscaped area of three thousand six hundred square metres, equivalent to the building footprint. The three vertical forests wrapping a hotel and two apartment blocks will be energetically self-sufficient and will absorb seven tonnes of carbon dioxide annually and produce eight tonnes of oxygen. Construction will begin in 2020 with expected completion in 2022.

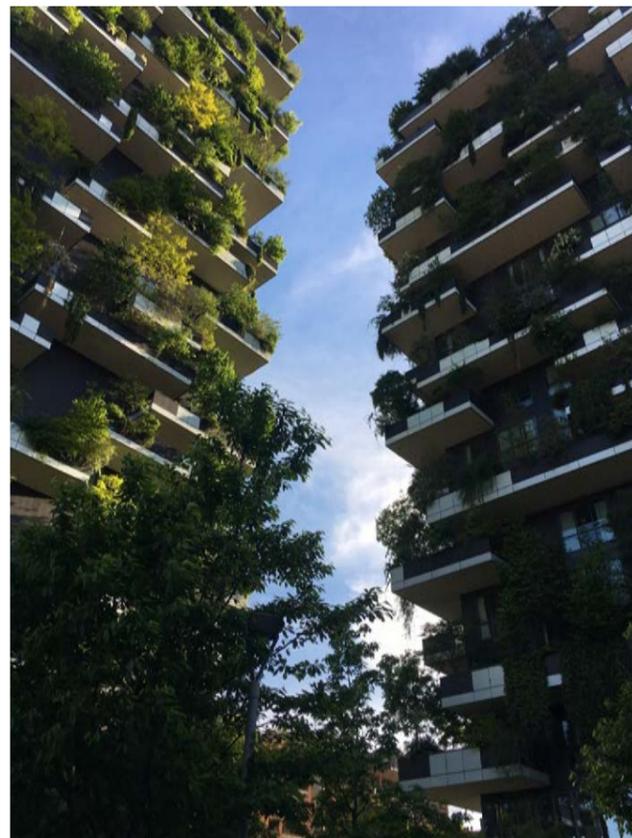
this page (both): Bosce Verticale in Milan, Stefano Boeri Architects
opposite (top): Torre Guinigi in Lucca Tuscany, a guiding influence for Bosce
opposite (bottom): Cairo vertical forest by Stefano Boeri architects, another instance of the global brand

The first vertical forest in Albania was commissioned in 2019 as a continuation of the new Development Plan formulated in 2016 by the Milanese office to increase green and wooded surfaces within and surrounding the City. The Tirana urban forest¹² will house over one hundred apartments over twenty-one levels with four underground levels. The project will be home to three-thousand-two-hundred shrubs and bushes and nearly one-hundred and fifty-five trees over an area larger than five thousand square metres. The plant biomass aims to improve the microclimate and mitigate atmospheric pollution by absorbing fine particles and carbon dioxide.

In Eindhoven in the Netherlands, the formula redirects itself from privately developed apartment and commercial mixed-use complex to become the first urban forest for social housing catering to young people leading an urban lifestyle. Commissioned in 2017 for concept design, the Trudo forest¹³ proposes nineteen floors of affordable apartments laced with balconies that collectively host hundreds of plants of diverse species. "The particular characteristic of the buildings in the Vertical Forest family is that of conceiving vegetation and living nature as actual cornerstones of the architectural projects, rather than mere ornamental elements."

Bosco Vertical: a living structure

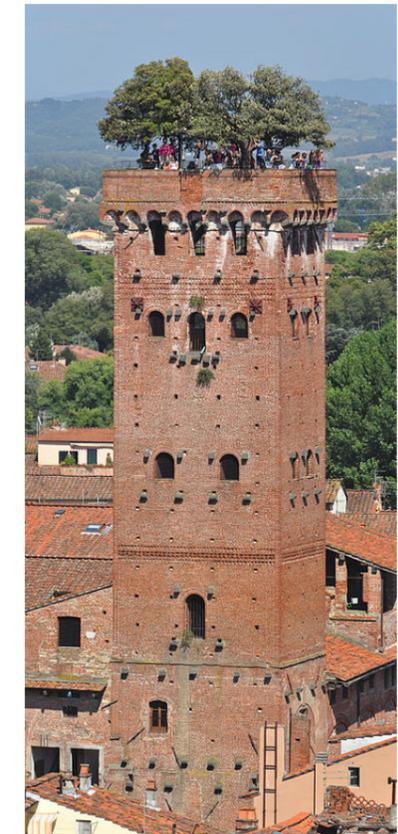
Regardless of individual preference for the form or aesthetic of the studio output, Stefano Boeri's studio provides a template that calls to question the role of the architect in the current climatic condition of parallel heightened awareness and inability to conceive the valley between climate questions and inventive solutions. In the Milanese style of exhibited rebellion, the architect has taken to the public format of exhibited narrative to share a manifesto on 'Urban Forestry'¹⁴ that is an open invitation to all; architects, urban planners, botanists, agronomists, forestry corps, tree growers, geographers, ethologists, landscape scientists, technicians, researchers and experts in green care and



urban forestry, real estate developers, administrators and representatives of local institutions and civil society, members and representatives of international organisations, funding agencies, universities and research institutes, and NGOs.

The case for foresting urban environments directs attention to the knowledge that the global population is growing and urbanising and that it is this swelling urban population who are to be held accountable for both consumption of natural resources and emission of fossil fuels like carbon dioxide. Forests are posed as a form of city in extinction in which their citizens, trees, have been found to bring great benefit to the cities of human growth. Forests and trees absorb nearly forty percent of fossil fuel emissions produced by Cities and the leaves and roots of a mature tree absorb carbon dioxide through photosynthesis which also helps reduce pollutants in the air.

The manifesto proposes that if we know Cities are largely responsible for the effects of climate change, then we know too that the construction, design and planning industries responsible for their making have an opportunity to become an integral part of their own future solution. Humans, especially those in the aforementioned lines of work, have a duty to launch a global campaign on urban forestry in order to maximise the Cities we know as forests by taking actions including; protecting parks and permeable surfaces, creating new forms of both, transforming city roofs and walls and barriers into gardens, the same with urban voids, create connecting corridors on streets, median strips and railway lines and generate peripheral forests around our Cities. What is striking about the Manifesto, reading between the lines, is the opportunity for work and the duty of councils and government agencies to transform from an economy driven by extractive resource operations to an intense digital and physical labour of ecosystem.



6.2 Broken Nature

Starting in 1923, the international exhibition of decorative arts was held every two years in the royal villa in Monza. The event intended to strengthen the relationship between industry, art and society in post-war Italy through the unification of creative expression from different practices. Ten years later, the biennale lengthened to a triennale and moved to Milan as an independent legal entity. Architect Giovanni Muzio designed the Palazzo dell'Arte as the Triennale di Milano's headquarters with twelve thousand square metres fit for adaptation to exhibitions. Gio Ponti and Mario Soroni were involved in guiding the institution in its early formation as a platform for international dialogue between creative disciplines.

"Precipitously over the past two centuries, some bonds have been severed irreversible. We - a "we" that does not implicate all humans equally - have deforested, drilled, extracted, and removed mountaintops. We have deposited radioactive particles that will disrupt habitats for centuries, polluted with pesticides, and driven species to extinction. We have distinguished languages, stifled traditions, indoctrinated, homogenized, and decimated cultural diversity. Some of those fraught bonds might be salvaged or repaired, but only with well-conceived interventions." - Paola Antonelli, curator¹⁵



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The Triennale has long provided a platform for Italy to have an outward conversation with the world while at the same time holding a mirror to the city itself. The fifth edition in 1930 was a survey of European modernist architecture and Italian rationalism, adopted by the Fascist Regime as a representation of Mussolini's enforcement of modernism. The eighth edition in 1947 directed focus to the nation's post-war reconstruction effort and experimental developments of the likes of Piero Bottoni.

The type of intervention celebrated within the Triennale takes form in a myriad of design methodologies ranging film, orchestra, political address, citizen engagement, ethical silk weaving, artificial intelligence and circular products for human consumption. Projects are arranged according to nation in a fragmented atlas that invites visitors on a tacit encounter of the five stages of grief and loss. This quintet of universally experienced emotions was first assembled in relation to human psychology by Elisabeth Kübler-Ross's 1969 book 'Death and Dying'¹⁶.

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The tenth Triennale in 1954 celebrated the industrial production of goods that were both a reflection and extension of a modern lifestyle at the centre of which stood Milan. Leisure and free time were explored from international perspectives in the 1964 edition curated by Umberto Eco and Vittorio Gregotti. That was a moment where radical ideas for architecture as a non-built practice emerged in an undercurrent reactive to the prevailing 'Made in Italy' ideal of modernism. The opening of the fifteenth edition in 1968 was delayed for a month due to an occupation by students of architecture demanding a free space to express their opinions in the exhibition to the theme of mass society.

These stages for everyone are experienced non-sequentially in varying and overlapping timeframes. Add to the reality that suffering grief or loss in any form can be an intense experience, a Biennale or Triennale is composed in a manner where a wealth of information is delivered to your every sense through a collage of text, colour, music, speech and sound. Pregnant with information overload is an almost unavoidable condition if you choose to engage with all that is on offer. As a compelling exhibition is rarely curated for a unanimous experience, I will walk you through a few interventions that deepened my understanding of natural loss. It would be fair to say I was already mad before paying entrance to witness an epic tale of erasure through the poetic translations of every nation's selected creatives.



What Happens at Milan Triennale?

In 1988 'Cities of the world and the Future of Metropolis' embraced the complexity of urban settlements while the eighteenth edition in 1992 confronted what those growing systems threatened through 'Life in Things and Nature: Design and the Environmental Challenge'. Aldo Rossi designed the exhibition to focus on the relationships between human beings, technology and environment through a program of courses, meetings and conferences among displays.

Urban Ecology in Broken Nature

I climbed the stairs and entered the first room to find myself sandwiched between two enormous screens depicting 'then and now' scenarios suspended from the ceiling. 'The Room of Change' by Accurat captured the pervasive industrial alteration of global landscapes using aerial photographs from the NASA archive. The project delivered parallel flashes of one landscape in two moments in time, from a perspective unseen to the everyday human eye, supplemented by a data infographic wrapping three walls of the space depicting the evolution of eight macro topics related to development.

Fast forward to the twenty-second instalment of the Milan Triennale in 2019. 'Broken Nature' critiques the development of those relationships over twenty five years from an anthropocentric perspective that a new attitude to the ecological world is urgent. It is a post-human account of the severance of Homo Sapiens relationship with, respect for and understanding of the natural world.

this page (top): 'Room of Change' by Accurat
this page (bottom): Trinitite sample, source: Enformable Nuclear News
opposite (top): fisherman and granddaughter at the natural green riverfront, Meganom's proposal for the Moscow River redevelopment strategy, 2014 in 'The Moscow River Age'
opposite (bottom): visitor to 'The Moscow River Age'



“As designers, the more we’re able to combine - “colder” and more sterile type of data, with layers of contextual, smaller and more relatable type of information, the more meaningful results we can achieve”¹¹⁷

I am then suspended in disbelief by what appears to be a magical yet disformed crystal is in truth a fragment of nuclear waste that has solidified in earth’s stratification as Trinitite. ‘Green Glass Rocks and Red Clouds: Post-nuclear Media Objects of the Anthropocene’ is an installation by Gabriel Ruiz-Larrea that draws out isolating denial not only for what has been damaged and lost but what has been accumulated and will never fade. It presents small green

geological samples extracted from the Trinity test site of 1945 near Alamogordo, New Mexico.

As described by Timothy Morton in his book *Hyperobjects*¹¹⁸, sixteen milliseconds after the detonation a weird light-green glass was formed as the explosion fused sand at temperatures ten thousand times hotter than the surface of the sun”. “The Nation of Plants” is

a fictional delivery to a bureaucratic human audience in a UN summit setting highlighting what can be learned from understanding the coexistence methodologies of earth’s oldest occupants, plants. The behavioural ignorance in its simple call to appreciation, a familiar image, is depressing. ‘The Moscow River Age’¹¹⁹ captures two hundred years of the trials and tribulations of Russia’s capital city river through ebbs and flows of damming, development, industrialisation and urbanisation and completes the timeline of its imaginary future as a method that reimagines bargaining. The past cannot be changed though the future can be reformatted is the takeaway message.

Broken Nature: a future manual

Reaching the acceptance stage of grieving is not always available but an opportunity might arise to withdraw to a space or medium that allows reflection and appreciation. In a quiet nook carved behind the two-sided mobile video theatre ‘Teatro Della Terra Alienata’¹²⁰ - theatre of the alienated earth - I sat quietly and reflected on the

national pavilion of the land I call home. Australia’s contribution to the Triennale disconnected stewardship of Great Barrier Reef from national management and instead connected it to a lifeline of care and pleasure of all species in partnership with a robotic technological network of surveillance and management.



this page (both): Repair, the Australian pavilion for Venice Biennale 2018 by Baracco & Wright with Linda Tegg, photographs: Rory Gardiner
opposite (top): compression cradle by Lucy McRae
opposite (bottom): Teatro della terra Alienata, Australian contribution by Amaia Sanchez Velasco, Jorge and Gonzo Valiente and Miguel Rodriguez-Casellas



The theatre invited its guests to bask in the leisurely state of being entertained and delivered uncommon truths about a wicked problem through projected imagination. Directed by Sydney based designers and academics Amaia Sánchez-Velasco, Jorge Valiente Oriol, Gonzalo Valiente and Miguel Rodríguez-Casellas, the project amassed two years of research and fieldwork with artists, scientists, researchers as well as staff and students of Architecture and Life Sciences of the University of Technology, Sydney (UTS). It provided a moment of playful contemplation on an overwhelming idea in a not-too-serious delivery of a very real disaster. Set within the Netherlands area ‘I See That I See What You Don’t See’, Lucy McRae’s “compression cradle”¹²¹ provided a more physical and intimate space for contemplation.

Biennale is an Italian word describing every other year and was originally used for the Venice International Art Exhibition first held in 1895. Venice in the late nineteenth century fell into decline and looked to London’s Great Exhibition of 1851 as a precedent for overtaking the City with the presentation of creative production as a means for economic reform. The interpretation was not an architectural one of

building a Crystal Palace in the watery city of Venice, but of transforming the City’s parks Giardini and later Arsenale from industrial wastelands to containers for the display of ideas.

In 2019 the Biennale¹²² is synonymous with around three hundred large scale contemporary design, art and architecture events scattered across various



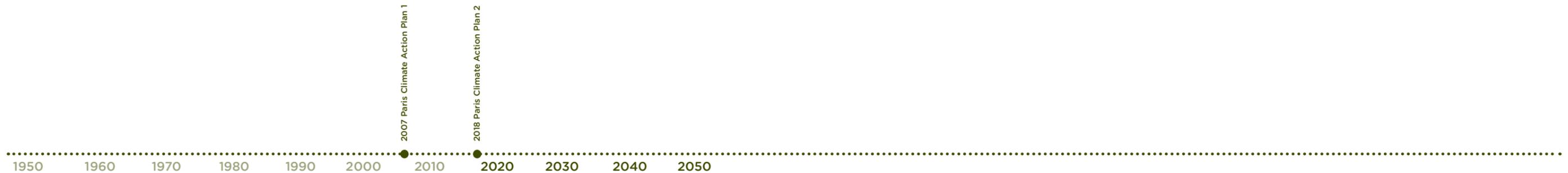
venues, gardens and galleries of the world’s Cities such as Sydney, Havana, Sao Palo and Kochi Muziris in India. Propositions for a post-natural and post-anthropocentric future are becoming a pivotal research and exhibition theme that shifts from an appreciation of the natural world to a repositioning of humans as the centre of its suffering. These include; Repair’, the Australian Pavilion for the Venice

Biennale in 2018, ‘After Nature’ exhibition of Janet Lawrence’s work at the Museum of Contemporary art, Het Nieuwe Instituut’s call for researchers in 2019 to the theme of ‘Burnout on a planetary scale’ and Manifesta 12 in Palermo ‘The Planetary Garden’¹²³.

7.0 Paris

7.1 Ivry Sur Seine

7.2 Clichy Batignolles



98 The capital city of France has a population of over two million people which is expected to remain stable through to 2050 but will be redistributed peripherally. A study published by the French national statistics agency Insee¹²⁴ predicts a quarter of the population in the four central districts will be displaced to the edges of the city in areas where vertical development is less protected under heritage law and where twenty percent of the future population will be over sixty-five years old.

This research focusses on two case studies that lie in Banlieus of Paris beyond the historic centre that is both adored for its romantic heritage as it is loathed for its filth. Towards the end of the nineteenth century Haussman¹²⁵ was commissioned to oversee Napoleon the third's plan to transform the city that had become overpopulated, dirty and riddled with regular outbreaks of cholera and typhoid into one with wide, tree lined boulevards with light, air, clean water and sanitation. It was the most extensive public works programme ever voluntarily carried out in a European city that rendered Paris a construction site for seventeen years. Twelve thousand structures were demolished to clear way for a hyper-efficient network of wide, straight roads and prominent buildings like Palais Garnier, Les Halles marketplace and new train terminals between which Haussmann blocks filled the blanks.

Beneath the streets a complex network of sewage, reservoirs and aqueducts were installed. Street furniture, lampposts, newspaper kiosks, railings and decorative bandstands decorated the ground plane and invited a safe and social environment for the flaneur, reveller and prostitute alike. A typical block is composed of shared courtyards wrapped by vertically mixed-use buildings occupied by; commercial across the ground and mezzanine, high ceiling residential for floors followed by one residential floor with typical ceilings and one servant residence beneath a mansard roof. The need for provision of social housing through the fifties and sixties gave rise to massive extension projects at the borders of cities all over Europe.



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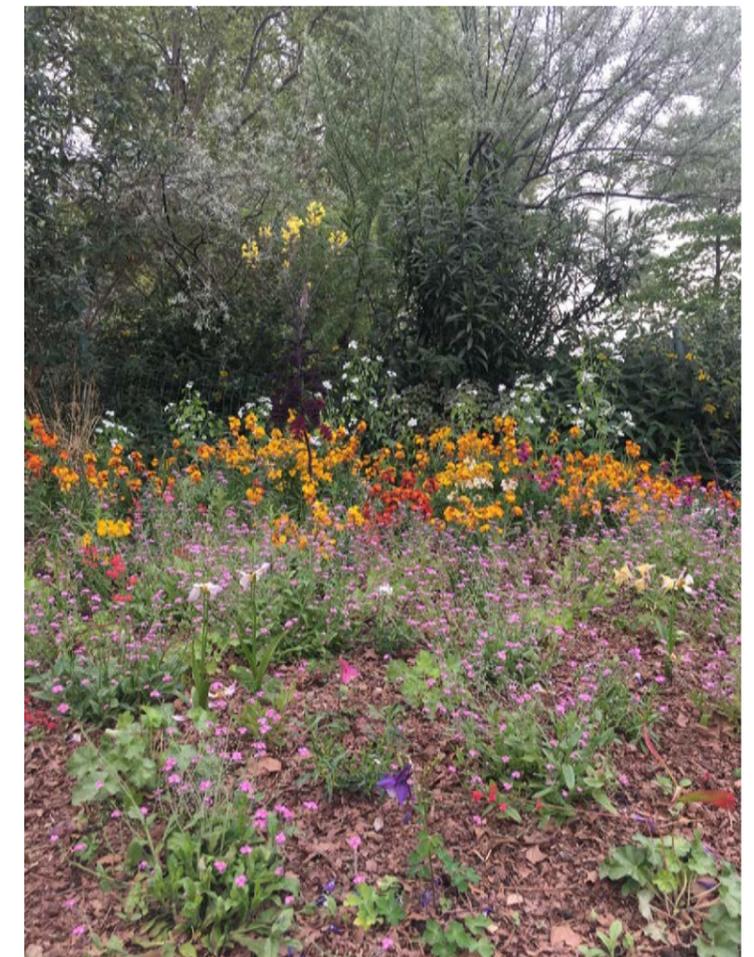


The planning and design of these 'dormitory' towns were enamoured with four urban functions - living, working, recreation and circulation - that remain the legacy of the Congress of Modern Architecture (CIAM) in 'The Functional City'¹²⁶. The French government labelled these areas 'Zones Urbaines Sensibles' for their expression of socioeconomic dissatisfaction and large populations of unemployed immigrants.

Planning Promises

In May 2018, the City of Paris published 'the Paris Climate Action Plan: towards a carbon neutral city and one hundred percent renewable energies'¹²⁷ an plan of action through to 2030 and ambition to 2050. Emissions in Paris are divided into local and outer Paris emissions, the first related to the energy consumption of the residential, service and industrial sectors, city transport and waste and the second to the upstream emissions prior to consumption, associated with the food and construction sectors as well as road, water and air transport. Paris aim to erase emissions in the local category, while achieving an eighty percent reduction outward of that.

In the report, the City targets building and urban planning changes in its transition to carbon neutrality and renewable energy. In creating a resilient city that ensures a high-quality living environment, water is marked as a resource to be protected and better distributed in its diverse forms while land will focus on biodiversity. Paris have set six operational actions to steer the transition through to 2030; greenhouse gas emissions down fifty percent, carbon footprint down forty



percent, energy consumption down thirty-five percent, renewable energies to make up forty-five percent of overall consumption, become a zero fossil fuel area and conform to world health organisation standard for air quality.

It was here in the capital city of France in 2015 that the 'Paris Agreement' to reduce climate change on an international scale was negotiated during the COP21, the twenty-first annual conference of the parties to the 1992 United Nations Framework Convention on Climate Change. The agreement became effective on Earth Day in 2016 when one-hundred-and-seventy-four nations signed the agreement and began adopting it in their legal and planning systems. Ahead of the Paris COP, parties submitted Intended Nationally Determined Contributions (INDC) including a target for reducing greenhouse gas emissions and a plan to achieve the target.

From an ambitious and early start with the Climate Action Plan of 2007, Paris set out to reduce emissions twenty-five percent by 2020 and in 2014, had achieved a ten percent reduction from 2004 levels. Since her election in 2014, city Mayor Anne Hidalgo has fiercely confronted the challenge of transforming a historic city whose buildings and connections were set in stone well before environmental and sustainable planning were understood. In her five-year term, Hidalgo has become the public enemy of many Parisians critical¹²⁸ of the transformational works to upgrade the heritage city through the erasure of the automobile and the parcelling of public land to private development.



this page (top): Avenue de l'Opéra, created by Haussmann, as painted by famed artist Camille Pissarro 1898
this page (bottom): littered gardens in Paris city centre
opposite (top): wildflowers in gardens by the Seine
opposite (bottom): Arènes de Lutèce, Paris

7.1 Ivry Sur Seine



102 **this page (top):** walking through Ivry Sur Seine
this page (top): walking through Ivry Sur Seine
opposite (top): aerial image of Ivry Sur Seine, source: the funambulist
opposite (bottom): aerial image of Les Olympiades by Michel Holley, source: Flickr

Banlieues are peripheral administrative entities beyond the city proper of Paris that account for eighty percent of inhabitants of the Paris metropolitan area. Since the annexing of the Banlieues of Paris in 1860, peripheral communities have extended their boundaries very little beyond their original delimitations. The 'Banlieues Rouge' are the outskirts districts of the City where the French Communist Party have held mayorship for extended periods, of which Ivry-sur-Seine is one.



Ivry Sur Seine is approximately five kilometres south-east of the centre of Paris and is home to over sixty thousand residents, a large population of which are Vietnamese and settled in greater Paris through the seventies following the Vietnam War. From 1925 since the end of Nazi occupation through 2015, the office of mayor was held by just three members of the communist party.

Emphasis has been placed within the Banlieue Rouges on a significant amount of social and affordable housing to accommodate a population often in a situation of economic precariousness. Thirty percent of Ivry-sur-Seine's housing is social, well exceeding Parisian legislation that enforces municipalities of over three thousand inhabitants to provide at least twenty-five percent of social housing by 2025, up from twenty percent in 2020.

The architecture of Ivry-sur-Seine is a radical style of brutalism recognisable throughout the neighbourhood from different perspectives as a fractured prototype of triangular volumes that aggregates to form collective housing and dissipates to make way for terraced gardens and open access paths that carve away space at the ground plane for commercial and public life.



103 *"Although the most radical elements of Ivry's architecture (social housing and co-property) are well-known to be the design of architect Jean Renaudie (1925-1981), the patriarchal history of architecture often forgets the fact that none of this architectural project would have been possible without the continuous work of his wife Renée Gailhoustet. Such a common omission attests of the struggle that female architects had (and continue to have) to undertake in order to see their work recognized to the same degree than their male counterparts."*¹²⁹

What happens at Ivry-Sur-Seine?

Gailhoustet designed the towers Raspail, Lenine and Spinoza between 1963 and 1970 before becoming the architect-in-chief of the Banlieue in charge of its masterplan of over one hundred hectares, within which she commissioned her husband Jean Renaudie to design three of the ten buildings, Danielle Casanova, Jeanne Hachette and Jean-Baptiste Clement. The remaining seven buildings were designed by Gailhoustet herself.

Designed and built at a time of heightened Modernism, the Ivry complex proposed a forward-thinking alternative in its balance of residential and public amenity arranged in a complex aggregation where no experience is repeated and encounter is allowed for.





Within ten individual complexes that appear to morph and bridge into one super-project are forty social dwellings, private terrace gardens and shared courtyards of various scales, public pathways and stairways as well as offices and stores, the Antonin Artaud library and administrative spaces for the city.

“Nurtured by the thinking of Jean Renaudie and the critical break begun by Team X, in her projects she took the opposite course to the logic of the great public housing developments. Gailhoustet’s work on the geometry of forms resulted in both rich and complex architectural and urban configurations.” - FRAC on Gailhoustet¹³⁰

Renee Gailhoustet first studied Philosophy before switching to Architecture and graduating in 1961 from the Ecole des beaux-arts in Paris, where she met Jean Renaudie. She founded an architectural practice in 1964 and in 1969 became the chief architect for Ivry-sur-Seine.

“Architects are striving to find solutions to social housing for ordinary working people. Gailhoustet’s designs sought to solve these problems long before most modern architects were playing with their crayons.” - Rose Barfield on Gailhoustet¹³¹

Urban Ecology at Ivry-sur-Seine?

The residential tower neighbourhood of Les Olympiades designed by Michel Holley at the same time as the projects of Gailhoustet and Renaudie just one kilometre north of Ivry-sur-Seine in the Asian quarter of Paris, the 13th Arrondissement, reflects what was a more popular modern organisation of vertical stacked towers that cleared a large open square in their centre. This planning theory reflected the application of Le Corbusier’s theoretical modernism to the urban form in projects such as Plan Voisin pour Paris and Ville Radieuse, the Radiant City. In his words;

“The city of today is a dying thing because its planning is not in the proportion of geometrical one fourth. The result of a true geometrical lay-out is repetition, The result of repetition is a standard. The perfect form.”¹³²

Concrete¹³³ is one of many legacies of modern construction that has been revealed to have devastating effects on the atmosphere. It is the most widely used man-made material in existence and, after water, is the second most consumed resource on earth. Cement, the dry ingredient used to form concrete, is accountable for eight percent of global carbon dioxide emissions.

Concrete was transformed in architecture from modern applications concealed behind glass facades as the slab and column structures to brutalism, where its plasticity as a pourable material lent itself to façade expression of texture, form and undulation. Brutalist structures emerged through the sixties and seventies in the context of social equity and hope, especially in communist areas, as well as futurism.

“Brutalism suffered the consequences of communism being transmuted into totalitarianism, which made the popular culture portray Brutalism differently. Shared spaces become hazardous grounds, “honest” buildings become concrete monstrosity, and before you know it, Brutalism is associated with violence, which was crowned in Kubrick’s Clockwork Orange once and for all.” - Patina Lee on Brutalism¹³⁴

Ivry-Sur-Seine: A living structure

The selection of Ivry-sur-Seine as a case study for this research is not grounded in its use of the material concrete or in its expression of the brutalist style of architecture, but in the way both are deployed through the vision of Gailhoustet and Renaudie to create social space and ecological space through complex manoeuvres in both plan and section. This downscaling of the multi-residential typology in Ivry-sur-Seine carves a network of continuous triangular landscapes in three dimensions where various sizes where grasses, shrubs, flowers, birdlife and climbing plants have formed habitats.

The masterplan of Ivry-sur-Seine is an architectural enactment of the philosophical concept of **Rhizome**, where Deleuze and Guattari¹³⁵ borrow from the word’s botanic description of a plant system with multiplied root systems that simultaneously sprout and spread above ground in dispersed locations while remaining deeply connected beneath the soil.

I met with the Singaporean biomimicry expert Dr. Anuj Jain¹³⁶ to discuss the type of urban and architectural forms that support biodiversity in cities. Students in a post-graduate programme under the direction of Jain and Dr Nirmal Kishnani at the National University of Singapore uncovered six typologies of built form that are sensitive to species movement and habitats. The wild social housing complexes planned by Gailhoustet and Renaudie showcase all six in varying degrees across the suburb of Ivry;

1. **open and closed patch**, where the building is split in several blocks and arranged in a manner that delineates spaces open to the sky
2. **plateau**, where the roof or uppermost surface of an elevated form serves as a terrace
3. **tunnel and cave**, where a void is carved from the vertical volume of an urban form
4. **bridge**, where the plateau surface of exposed landscape spans between multiple structures
5. **hill**, where landscapes are stepped or terraced in intervals dictated by the building form
6. **cliff**, where the sheer vertical surface serves as a vertical planted wall for species



7.2 Clichy Batignolles

this page & opposite
(bottom): wandering
through Martin Luther
King park
opposite (top): TVK
apartment complex for
Clichy Batignolles

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In the 17th Arrondissement district of Clichy Batignolles in the north-west of Paris, a fifty hectare urban transformation of brownfield sites has taken place that cleared its centre for a ten hectare park around which three thousand new homes, offices, businesses and infrastructure as well as housing law courts and the criminal investigation police have taken residence. In 2003, the site was originally intended to serve as the Olympic village in an unsuccessful bid for Paris to host the 2012 summer games with a leading approach to environmental sustainability and energy efficiency. This intention endured in the project plan for Clichy Batignolles that began in 2008, where the energy standards applied are equal or higher to what authorities will have in place across France by 2020.

Clichy-Batignolles offered a rare opportunity for Paris to respond to climate change and the required energy transition on a district scale, which required ongoing consultancy, workshopping and feedback to balance which systems could be shared and which needed to be localised by plot. The plan for the district is quite simple, building volume and density distributed vertically above minimal footprints that frame the periphery in order to maximise space on ground in the centre of the district for ecological territory as well as services. It is a super-typology whose simplicity at the masterplan scale takes on an almost swollen quality in comparison to that of the neighbourhood or even the human body.

Byera Hadley Travelling Scholarships Journal Series

Urban planner Gerardo del Cerro Santamaria describes these megaprojects as reconfigured space where national, regional and local authorities come together to accommodate density for expanding populations. In the case of Clichy-Batignolles, the political and planning policies being experimented with and challenged are in earnest of environmental sustainability but do so by erasing historic context to make way for a tabula rasa from which to grow.

"[Megaprojects] are often trait making. That is, they are designed to ambitiously change the structure of society. This is opposed to smaller and more conventional projects that are trait taking - they fit into pre-existing structures and do not attempt to modify them. Megaprojects have spread in urban areas around the world. They have often caused displacement of inhabitants, thus generating strong criticism from civil society." - Gerardo del Cerro Santamaria¹³⁷

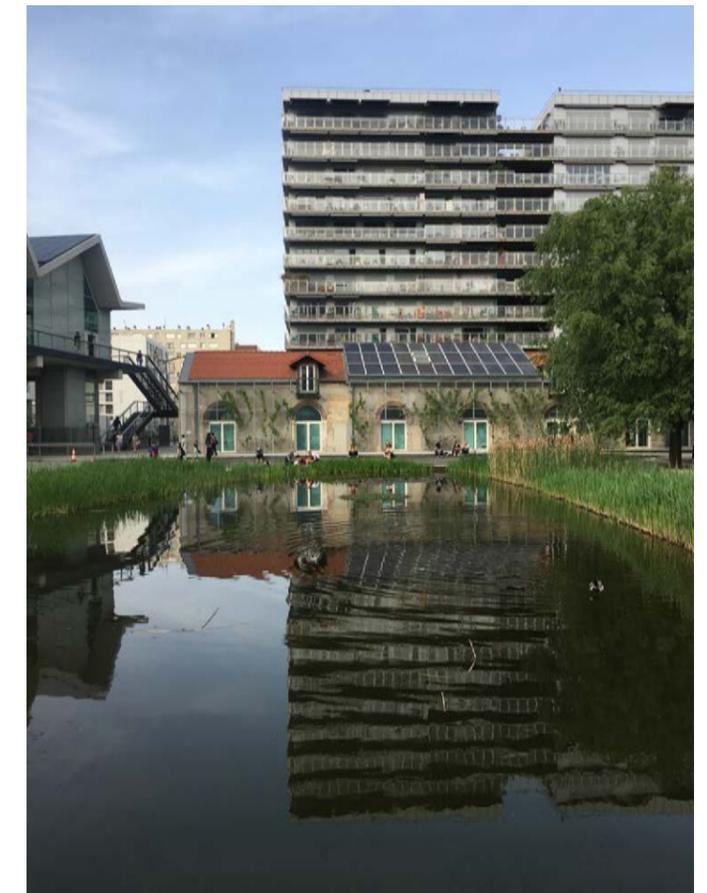


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What happens at Clichy Batignolles?

Two years after the announcement came of London as hosts for the 2012 Olympic games, the development of Clichy-Batignolles¹³⁸ as a 'Nouveau Quartier Urbain' or new urban district for metropolitan Paris began. The program distribution across more than fifty hectares includes; ten hectares of park, 3,400 residences, 140,000 square metres of offices, the courthouse and judicial police of Paris, 30,000 square metres of shops, culture and leisure as well as almost 40,000 square metres of public facilities.

Martin Luther King Park¹³⁹ was the first piece of the puzzle to be delivered, establishing the central public forum and connection route beyond which individual plots to the north, east and west were commissioned to various architects and real estate agents to be delivered between 2008 and 2019. Each block is multifunctional with schools, shops, cultural and hospitality venues occupying the lower floors that are accessible from ground with space for living and working on the upper floors. Space has been saved by creating shared terraces, rooftop gardens, kitchens, laundries and concierge facilities between residences and offices. The towers of Clichy-Batignolles were permitted to exceed Paris' thirty-seven metre height restriction and rise as high as fifty metres in some locations.





An important gesture of the projects as a collective network was to localise urban services that were previously relegated to the industrial outskirts including waste collection and sorting, production of energy and water storage as well as railway maintenance, bush and coach parking and concrete production. It is an architecture playground of local and international design¹⁴⁰, with the courthouse by Renzo Piano and mixed use projects delivered by; MAAST, Babin Renaud, Avenier Cornejo, Fracis Soler, Atelier du Pont, Peripheriques, Thibaud Babled, Le Penhuel & Saison Menu & Sud Architects, Querkraft Architekten & Sam Architecture and Aires Mateus.

Urban Ecology at Clichy Batignolles

As a model for sustainable development, the master plan for Clichy-Batignolles integrates technologies that align or exceed targets set by Paris in its 2050 Plan. Building energy consumption is limited to fifty kilowatts per hour with heating limited to fifteen in accordance with Germany's stringent Passiv Haus¹⁴¹ certification. All buildings are connected to a heating grid supplied with geothermal energy that uses natural heat from a warm groundwater table beneath Martin Luther King Park. A total surface area of three and a half thousand square metres of photovoltaic panels are distributed across facades and rooftops to produce approximately forty percent of the energy consumption required to power Clichy-Batignolles.

Six and a half thousand square metres of private gardens scattered throughout the built form and sixteen thousand square metres of green roofs form connected ecological pathways between Martin Luther King Park at the centre of the 17th Arrondissement and the Parc Monceau, Bois de Boulogne and the cemeteries of Montmartre and Clichy at the periphery of the master plan. Impermeable roadways make up only twelve percent of the total ground area and only fifty percent of rainwater runs to the sewer system, the remainder collected and diverted to wetlands in the park. Rainwater supplies forty percent of irrigation to landscapes throughout the district which collectively act as filters to capture carbon and purify the air through photosynthesis. The plants and trees collect rainwater, sprinkler water and ground water and convert it into water vapour that cools the warming ambient air.

Atelier Jacqueline Osty¹⁴² are responsible for the thirteen million dollar engineered ecosystem of Martin Luther King Park that was awarded the Ecojardin gold standard for management of green spaces in 2015. Over five hundred species of tall trees, shrubs, grasses and brambles are distributed according to their ecological characteristics; Amelanchier berries for the bird and tilia trees for better leaf composting, etc.

Clichy Batignolles: A Living Structure

"Reinventing Paris"¹⁴³ was an open call launched in 2014 for the innovative redevelopment of twenty-three sites owned by the city that attracted almost four hundred submissions bringing together architects, city planners, real estate developer, artists, start-ups, landscape architects and companies. "Reinventing 2" launched in 2017 with a similar invitation to private partnerships for the design and management of thirty-four subterranean complex, public plots including tunnels, unused reservoirs, parking lots, former abattoirs and ghost metro stations.

This method of permitting complex parcels of land to be purchased by winning schemes, from which the city banked six hundred million euros in the first round, attracted criticism on the sustainable value and design excellence of chosen proposals. A satirical counter-contest 'Reinventer Pourris'¹⁴⁴ confronted the scheme with a sceptical attitude toward the values and intentions of the city planning office by promising an award to whoever invented the most ludicrous lampoon of a current Parisian project.

One of the twenty-three sites for the original competition, beside the tower of the Tribunal de Grande Instance designed by Renzo Piano, was awarded to the stream building by Phillippe Chiambaretta Architecte¹⁴⁵ in collaboration with partners and start-ups including; Topager, Zoku, Spaces, Nu and Noctis and proposed ongoing programming with inhabitants and the neighbourhood. The vision confronted the fact that a growing number of the workforce are digital nomads operating in small collectives that allow agile movement in a shared economy that seek a "third space" from which to work. The tower constructed from timber acts as a living metabolism for this emerging workforce, harvesting produce on a rooftop farm of over one-thousand square metres to be served in restaurants and sold in stores on site. Waste is converted to a shared compost unit which provides nutrient fertiliser for the next batch of crops in a cradle-to-cradle¹⁴⁶ design approach.



this page (top): satirical website 'Reinventer Pourris' undergoing maintenance
this page (bottom): wild flowers in Martin Luther King Park, Clichy Batignolles
opposite (top): hyper-efficient density planning of Clichy Batignolles around open parkland and transport
opposite (bottom): human scale dense vegetation to explore in MLKP

8.0 Singapore

8.1 Hortpark & Cooled Conservatories

8.2 SDE4

2015 Singapore Sustainable Blueprint



110 If the radical relationship Singapore has orchestrated between ecology and economy throughout its history were to be rendered in film, the set would surely be its Botanic Gardens. I arrived to the nation-state island shortly before the sun and became destined for the only public space with open gates from 5am daily. The Singapore Botanic Gardens' eighty-two hectare site has been UNESCO world heritage listed since 2015 and today is home to over 10,000 species, botanical researchers, Singapore National Parks (NParks) management and the people of Singapore. Small details collected along my meander through the landscape and its library, herbarium, and green gallery amassed to form an ideal introduction to the horticultural practices that have shaped the biological stewardship Singapore is renowned for; a wanderer paused by the river edge to refresh his toes in cool liquid, horticulture staff spritzing ferns in the rainforest, runners racing through the garden paths, squirrels, butterflies, bees and lizards escaping my Olympus lens-click, a relieving nap under a coconut palm in the medicinal garden, the concept of economic gardening, the prosperity brought to Singapore from *Hevea brasiliensis* (rubber tree) and orchid hybridisation, Lee Kuan Yew's legacy and an ever-present global call to protect disappearing species in our lands and waterways.



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Although only five percent of primary vegetation remains in Singapore, over three quarters of the two-thousand total native vascular plant species are classified as extant and scaled throughout the urban fabric from terraces, mesh facades and median strips to vast expanses of national parks. One hundred and sixty years of the botanic garden's operation can be traced through several important stages of evolution. British influence is the first, as the original garden was laid out in English landscape style when it was overtaken in 1874 by the British colonial Government. Kew-trained Botanists brought with them twenty-two para rubber tree seeds whose planting in 1877 initiated the rubber tapping years where experiments carried out for the botanic conditions and commercial yield coincided with the explosive growth in global demand from the automobile industry for the trees' sap.



Laboratories were set up in 1928 for the first orchid hybridisation experiments that formed the foundation for the cut flower

industry and have since evolved and developed two thousand hybrid species. Hundreds of microscopic orchid seeds wrapped in cotton fluff are extracted from a single vanilla pod to a nutrient medium in the in-vitro environment of the Tissue Culture Laboratory, where they can take five years to flower from the pollination

stage. Research in botany and horticulture saw the Botanic Gardens up to the Japanese Occupation of World War Two and post-war independence in 1945.

When Singapore became independent from both Britain and Malaysia in 1959, president Lee Kuan Yew¹⁴⁷ embarked on what might be historically considered the most productive single tenure of any politician where education, economy and ecology are collectively considered. One hundred years after the Botanic Gardens had opened, Kuan Yew's government

envisioned the greening of Singapore not as a collection of fragmented garden spaces throughout a city but a city nestled in one large landscape of biodiversity.



this page: residential street planting in Singapore
opposite (top): five foot way in a residential neighbourhood in central Singapore
opposite (bottom): layers of development from historic housing in the foreground to CBD in the background

Planning Promises

Singapore was a later addition to the case studies for this research after many recommendations insisted on the forward-thinking urban planning of the nation state that has evolved to the protection of the natural world in both physical and digital space. Singapore Sustainable Blueprint, published in 2015 and reviewed in 2018, was developed to guide the city toward the contemporary challenges of climate change, rising sea levels, dangerous pathogens and heightened demand for water and energy resources due to a growing population and increasing urbanisation.

“In our early years, even as we provided basic necessities for our people such as affordable housing, public infrastructure, clean water, sewers and roads, education and jobs, we did so with “sustainable development” in mind long before the expression became popular.” Lee Hsien Loong, Prime Minister of Singapore¹⁴⁸

Two years after Singapore gained independence, the Garden City program of 1967 was launched with a vision to make Singapore a city within a garden and the government set to planting trees around public housing estates, cleaning streets and the heavily polluted river through the city as well as replacing polluting industries, conserving nature reserves and building community parks. NParks¹⁴⁹ was established in 1998 to support Singapore's 'Garden City' vision of integrating nature not only in the built environment but in people's lifestyles. It was the most recent rebrand of the Parks department in an evolving shift towards the provision of natural space that considered human interaction and people's daily motions.

The 'Parks and Recreation' department replaced 'Parks and Trees' in 1976 directly after an act legislated requirement for area set aside for parks and trees among all housing, commercial and transport developments. Eighty percent of Singapore residents live in over a million



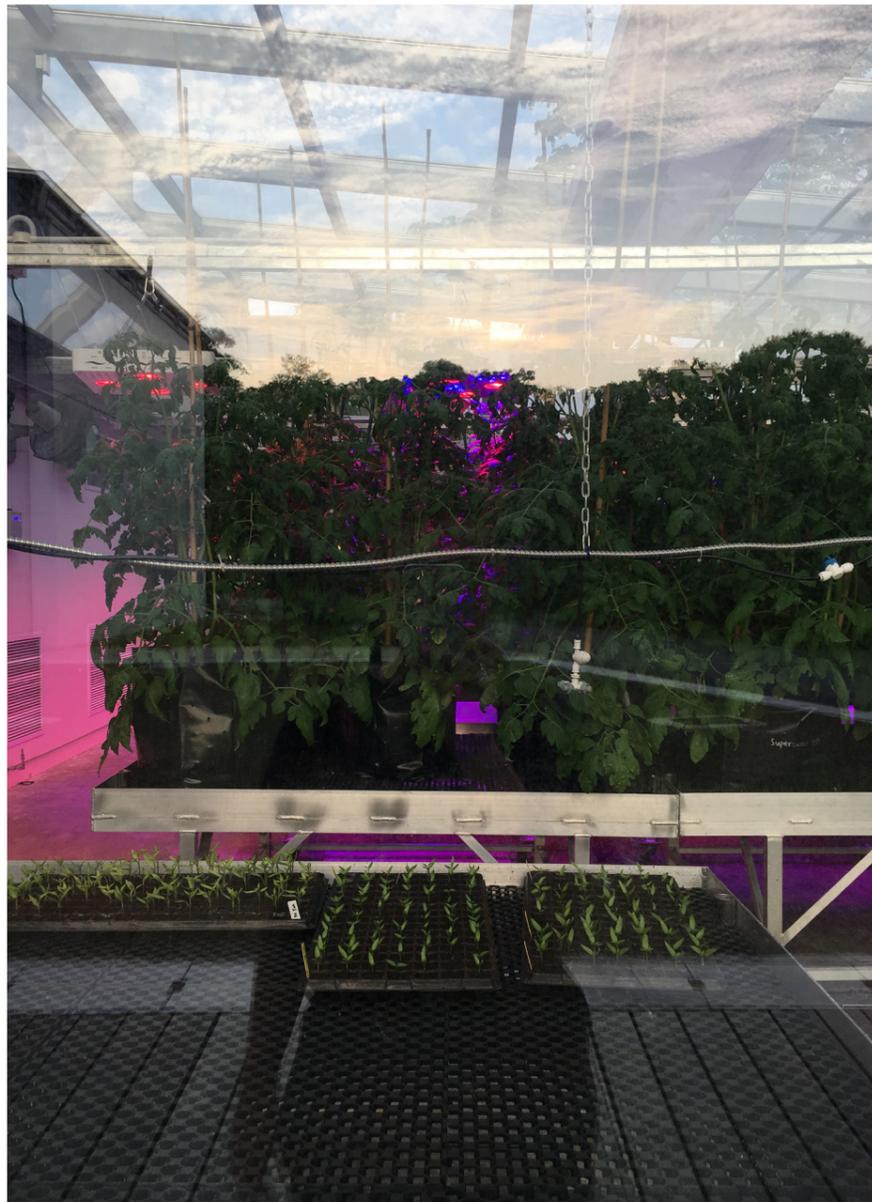
social housing apartments in airspace where planting in deep soil on private ground is a luxury unavailable to most of the community. In this context of density, interstitial zones become a priceless commodity.

The blueprint sets seventeen clear targets to be met by 2030 by measuring the increase or decrease required in the performance of systems; amount of skyrise greenery, green spaces: parks and park connectors open to recreational activities, blue spaces: waterbodies and waterways open to recreational activities, length of nature ways, proportion of households with less than a ten minute walk to a park, length of cycling paths, model share of journeys during peak hours made via public transport, length of rail network, proportion of households with less than a ten minute walk to a station, number of active green volunteers, number of community in bloom gardens, proportion of buildings to achieve BCA Green Mark Certified rating, energy intensity improvement, domestic water consumption, national recycling rate, air quality and flood prone areas.

A review of the blueprint by the National Environment Agency¹⁵⁰ revealed that in three years, Of the seventeen target indicators, most either remained stable or improved aside from several cases where data was not yet available. Improvements over that period include; twelve additional kilometres of nature ways had been created and twenty kilometres of the Park Connector Network as well as thirty-six Active, Beautiful, Clean (ABC) water projects, eighty new bus services rolled out, eighteen roads turned into car free zones and car free Sundays implemented, new housing estates with over five hundred dwellings to have Pneumatic waste conveyance systems and dual chutes for waste and recycling implemented in all new towns, on-site waste treatment pilots at Hawker centres, support in schools to recycle food waste in compost and carbon tax of \$5 per tonne of greenhouse gas emission introduced to producers of more than twenty-five thousand tonnes.

8.1 Hortpark and the Cooled Conservatories

this page: Prototype Glass-house Complex pavilion at HortPark, NParks
opposite (top): and aquatic ecologies blurring at Gardens by the Bay
opposite (bottom): inside the Cooled Conservatories



HortPark reserves nine hectares of space to the south-west of the financial flow of Singapore for the growth, production and participatory education of its native flora. Inside the park's borders are an offering of landscapes, structures and programs that collectively form a new hybrid typology of ecology and education; gardens to while away the afternoon in, a plant nursery called HortMart, community gardening allotments, gardening consultancy, a bee trail, vertical wall and roof horticulture product displays for architects, planners and developers, public and school group workshops and a butterfly breeding sanctuary.

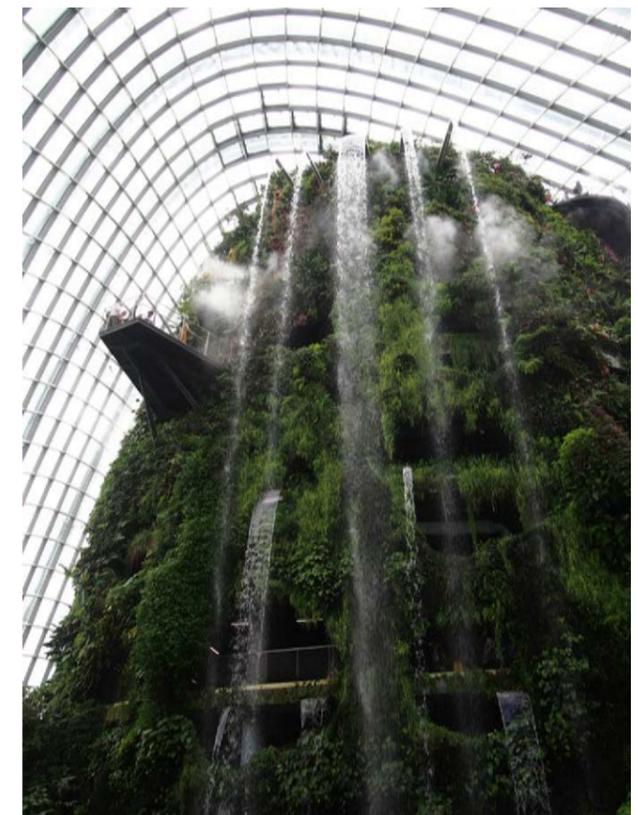
Over eight hundred tree species and forty-thousand types of shrub are planted in HortPark, excluding those planted by other landscapers and community gardeners. Hortpark was designed to act as a point of interconnection between Kent Ridge Park, Telok Blangah Hill Park and Mount Faber Park to form a wider network of ecological territory managed and operated by the government national parks department. HortCentre is its welcome structure, designed by Singapore based architecture firm MKPL, that serves to orient you to experiences on offer within the park while also framing you within a view that extends over one of the nation's last untouched landscapes to the water's edge at the port.

"The central idea was a large canopy to define sheltered space, like a rain tree creating shaded space under its canopy. This takes the form of a horizontal roof plane supported on columns like a 'grove of trees'. A sheltered open space is created beneath, filled with natural light and ventilation. This space is raised on a plinth and positioned to frame view towards the ridges." MKPL

From Hortpark to the Cooled Conservatories

After the gates close and the lights go out, plant life continues blooming in the Prototype Glasshouse Complex, a research facility of NParks used to experiment with plant growing conditions for the simulated environments of the Cooled Conservatories at the international sensation that is Gardens by the Bay. Designed by Wilkinson Eyre, the Flower Dome and Cloud Forest are two ticketed spaces that collectively cover an area over twenty-thousand square metres and showcase flora of the two environments most likely to be affected by climate change; the cool-dry Mediterranean zone in the flower dome and the cool-wet tropical montane in the cloud forest.

Integrated systems¹⁵² have been implemented for the demanding brief to create artificial interior environments enabling Mediterranean and mountain plants to thrive in the tropical urban heat of Gardens by the Bay in Singapore. A biomass furnace burning discarded plant matter provides energy to generate a cooler climate inside the biomes of the cooled conservatories. It is a sustainable system with a low footprint that minimises dependence on the Singapore electricity grid and reduces the use of fossil fuels. Horticultural waste from urban street tree pruning is diverted from landfill and used as a source of fuel to generate energy to feed a biomass combined heating and cooling plant for the entire Gardens by the Bay.





this page (top): clean up after the regular tourist attraction light show in the Supertrees
this page (bottom): Prototype Glasshouse Complex pavilions at HortPark
opposite (top): inside the Cloud Forest, Cooled Conservatories
opposite (bottom): venus fly traps on show inside the Cooled Conservatories

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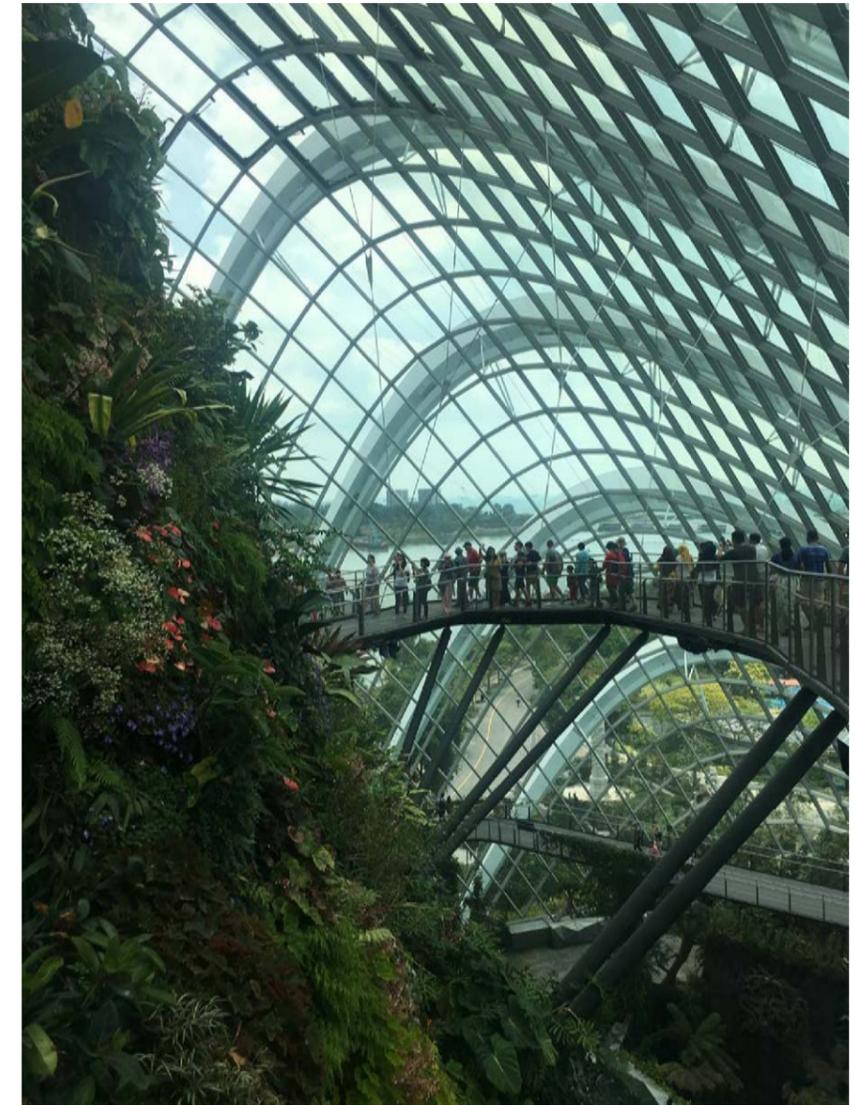
The Cooled Conservatories¹⁵³ have a composite structural system of a grid shell in tandem with a radial external structure of arched steel ribs that support lateral loads. The project was named WAF World Building of the Year in 2012 and received the RIBA Lubetkin Prize in 2013. Gardens by the Bay was a one-billion-dollar project that covers one-hundred hectares and has been visited by over fifty million people since its opening in 2012. The project was awarded through a design competition in 2006 to a collaborative team of Grant Associates, Wilkinson Eyre, Atelier Ten and Atelier One. The design of Gardens by the Bay has been inspired by the cycles of nature, creating a sustainable system between the indoor biomes and the Supertrees, eighteen structures ranging from twenty-five to fifty metres that capture rainwater, collect solar energy and act as substrates for climbing plants.

Wilkinson Eyre, Atelier Ten and Atelier One. The design of Gardens by the Bay has been inspired by the cycles of nature, creating a sustainable system between the indoor biomes and the Supertrees, eighteen structures ranging from twenty-five to fifty metres that capture rainwater, collect solar energy and act as substrates for climbing plants.



HortPark and Cooled Conservatories

The Prototype Glasshouse Complex at HortPark is the rehearsal room for the public spectacle that is Gardens by the Bay. Glasshouses No.1 - 4 propagate plants native to semi-arid sub-tropical climates like South African, Australia and the Mediterranean basin like lavender, rosemary, grapes, kangaroo paws and snapdragons. Glasshouses 5 - 6 are home to plants found in cloud forests at altitudes between 1,500m and 2,800m on Mt Kinabalu and Mt Kilimanjaro like rhododendrons, pitcher plants and brugmansia. Cooling these spaces is two part process of firsts extracting humidity from the air with a desiccant then cooling it, a process driven by a cogeneration system that uses a micro turbine to produce the electricity to power the chillers.



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Waste heat created in chilling is used to regenerate the desiccant and form an efficient, circular system. The research complex also has a pond that collects rainwater for irrigation and for testing water-recycling strategies. It uses plants like reeds, cattails, aquatic canna, sweet flag and water lilies to filter nitrates and phosphates from the water. There is an outdoor gallery of green walls that test the best methods for growing vertical flora species such as epiphytic ferns, bromeliad and tropical succulents.

“Objects are neither flora nor fauna and yet they mimic proliferating vegetation, a jungle for the new wild man of modern times.” - Henry Lee, artist on exhibition in Singapore Botanic Gardens Green Pavilion

HortPark is to Gardens by the Bay what the artist's studio is to the public exhibition, less curated and more inviting of self-expression and active participation in the systems that constitute the reality of a 'City in a Garden'. Like the moon and the sun, one of these is the stage for the one-night fantasy of the cosmopolitan tourist, anxious not to miss a spectacle. The other is returned to, over and over, for quiet entertainment or the curious mind-body experience of learning about microscopic biological processes that happen under the watch of the sun. The way natural systems beneath Singapore are being uncovered and connected is the task of NParks today and will likely become the ongoing legacy of the preservation of the nation's species and ecologies.



8.2 SDE4 NUS School of Design & Environment



SDE4 is an acronym for the fourth building of the faculty of Design and Environment at the National University of Singapore (NUS) that welcomed its first students in early 2019. The campus

lies to the west of the downtown area and the botanic gardens, nearby Hortpark. It is the first net-zero energy building in the tropics, meaning the total amount of energy used by the building on an annual basis is equal or greater than the amount of renewable energy generated on site.



London based Serie Architects won a competition together with local practice Multiply Architects and Surbana Jurong in 2013 to design the facility which forms part of a wider campus redevelopment of the University. The design carries the principles of tropical architecture in Southeast Asia, using natural cross ventilation and shaded balconies to create a naturally comfortable environment.

Between the relationship it has formed with its context and the invitation it offers its occupants to take part in both its programming and energy technologies, SDE4 is a marvellous example of how ecologically sensitive design principles can be made practically applicable and available to the students who will be tasked with designing the energy efficient structures of the future city. The building serves not only as a box in which content can be taught to students but a container that itself serves as a canvas for test-bedding and as a living laboratory.



“SDE4 represents a ‘scaffold’ for learning, teaching and research designed for the 21st-century university. Not only does it envision how we teach today, but it also paves the way we might teach in the future.”
- Erik L’Heureux, Vice Dean, SDE4¹⁵⁴

What happens at SDE4?

The building feels at ease and effortless in its landscape despite how hard it works to maintain an intertwined network of energy systems and moving parts. It is a simple composition of large open floor plates that house individual classrooms as closed interior environments between which teachers and students circulate in the open air under the protective shade of a large canopy roof. The eight and a half thousand square metre building allocates twenty percent of its floor area to design studio space as well as an open events plaza, public spaces, a café and library, research centres, staff offices and workshops.

The most fascinating space is the prototype workshop, where the shading screens that adorn the façade can be removed to allow large structural members into the space where 1:1 building components can be modelled and used for testing.

Large open circulation paths and stairways that take the place of ‘corridors’ make the single structure feel more like a campus itself that bleeds into other areas and opens out to the landscape and city surrounding. Flexibility and efficiency are embedded in most of the studio spaces that allow for adaptable arrangements to suit regular classes, studio presentations and exhibitions as well as potential future use.



this page (top): architecture studios on the top floor of SDE4 can be climate controlled by students through a mobile app
this page (bottom): SDE4 from afar, image: Serie Architects
opposite (top): outward vista from the learning terraces
opposite (bottom): Serie spared no detail, fine consideration was taken in every material and furnishing of SDE4

“Buildings are not isolated entities in their own context. They form an environment, a precinct or a neighbourhood that supports community activities, which is crucial for educational institutions. Our students and faculty get the opportunity to learn both inside and outside the classroom, and be engaged in an integrated process of designing, developing, constructing and operating state-of-the-art buildings that will, in turn, influence them to adapt their own behaviour when they occupy it.” – Lam Khee Poh, dean of SDE¹⁵⁴

Urban Ecology at SDE4

SDE4 combines passive and active strategies to achieve a net-zero energy rating. Interior spaces that require a controlled interior environment for learning over longer periods of time are minimised and so too are the overall demand on electricity for heating, cooling, lighting and general power and data that service them. The structural skeleton and skin of the building employ energy efficient materials such as solar screens and concrete as thermal mass as well as energy efficient fixtures to further reduce the building’s demand for energy.

The building is deliberately oriented east west to minimise direct heat gain and maximise the flow of prevailing winds. Facing the natural direction of wind flow allows cross ventilation through the open circulation spaces where the temperature can naturally fluctuate higher than the recommended range¹⁵⁵ from twenty to twenty-six degrees. The landscaping around the building provides shading, mitigates urban heat island effect with its porous drainage surface and reduces noise from the nearby traffic.

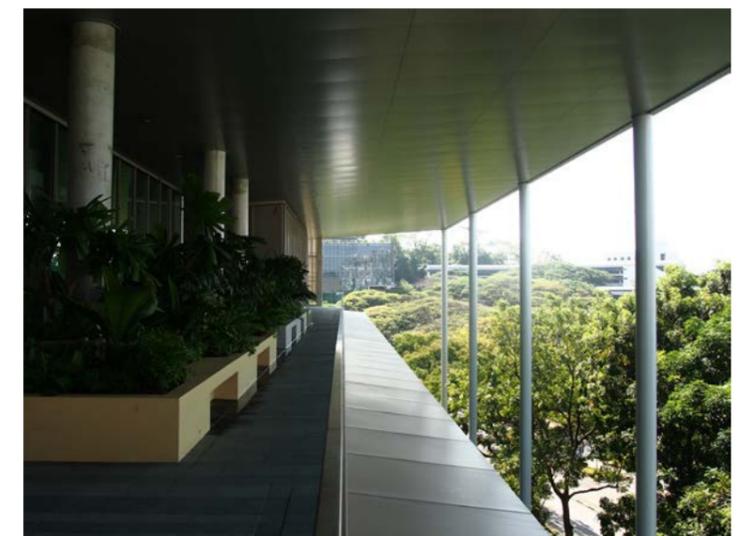
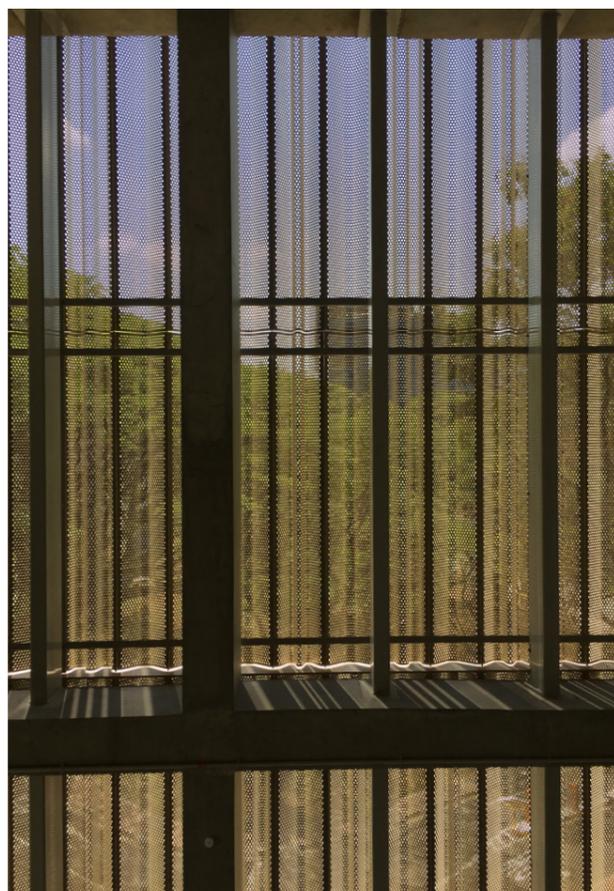
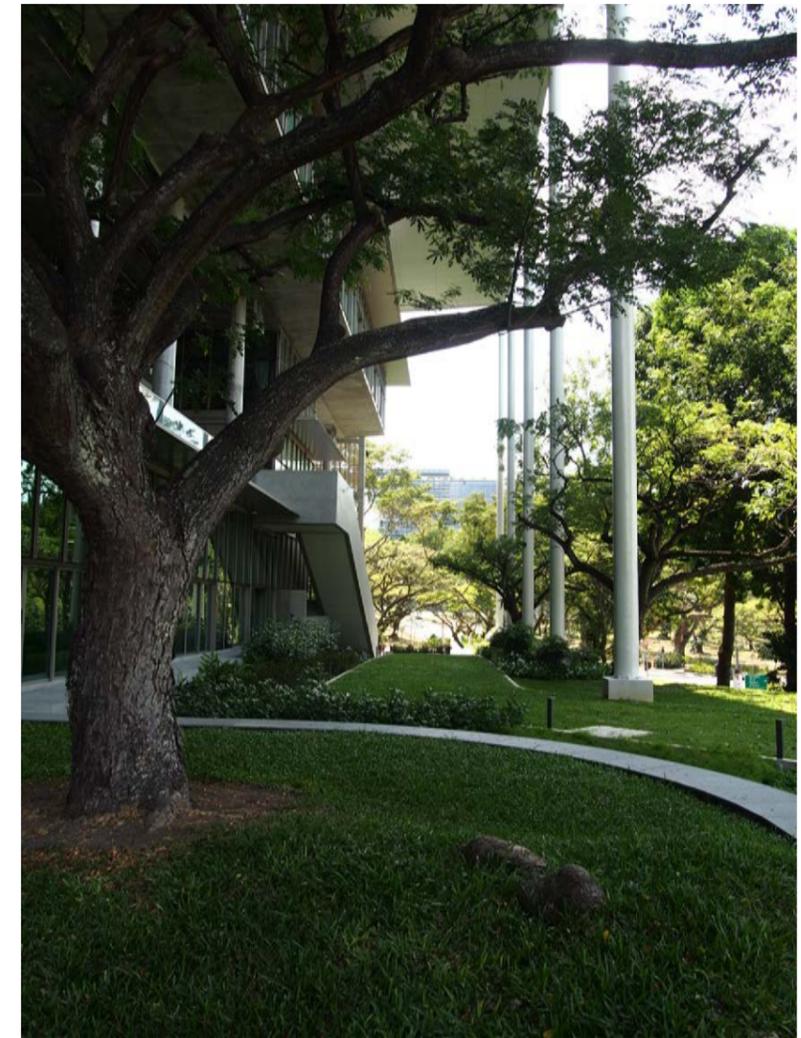
The system operates on a hybrid system for cooling that uses natural ventilation and operable windows as well as ceiling fans to enhance air speed and temperature to limit the need for air conditioning only to areas and times when required. Over twelve thousand solar photovoltaic cells installed on the roof generate over five hundred megawatts per hour of energy each year, which is average to the building’s total energy consumption.

SDE4: a living structure

Tapeesh Sood and his team at the Building and Urban Data Science Lab of NUS created the SDE Learning Trail¹⁵⁶, a simple web platform that gathers comfort feedback from its users who can scan QR codes at stations dotted around the building for detailed descriptions of six separate systems; water, wellness, tropical architecture, hybrid cooling, net zero energy and biophilic design. The platform offers graphic visualisations and explanations of how each building system works and users are prompted to provide feedback as they traverse the trail, helping the building management team understand the satisfaction of learners.

Rainwater is collected on the roof and diverted to a rainwater harvesting tank as well as a bio-retention basin set in the adjacent landscape that retains water for irrigation and other non-potable demands such as flushing and cleaning. The building uses biophilic design principles to engage in a meaningful relationship with its surrounding landscape and atmosphere which visitors can explore through a three-dimensional biophilic green map on the Learning Trail. As well as the surrounding landscaping, a garden has been installed outside the studios on the uppermost level that creates vertical continuity of the planted network.

Space match is an spatial recommendation engine using artificial intelligence that captures data submitted by students and staff via their personal devices to recommend the most comfortable place for a particular person to be working at a particular time. Spaces can be booked by members of other faculties, researchers or the public through the same app, encouraging coworking in the faculty and freedom of movement for the students.



this page (top): circulation spaces are shaded but not hermetically sealed, saving energy
this page (bottom): facade screens can be removed to allow large building components to be brought in/out for 1:1 student prototyping on projects
opposite (top): water captured on the roof is filtered and redirected for use in both the building faucets and the landscape irrigation
opposite (bottom): canopy roof protects and cools open circulation spaces from sun

Diagnosis: Tools for Reciprocity



122 The eight cities and sixteen projects investigated in this report provide a wide and diverse taxonomy of methods for “making cities” that balance the necessity and desire for rich ecologies to thrive with the emergence of future methods of architecture, of space making. **The question left open to the reader is; In rebalancing species with spaces, are city ambitions set in urban planning policy or gestures and collaborations in architecture projects leading the way?**

The macroscopic system is as vital as intermediary actions, though I would argue the latter is better placed change peoples minds for it is tangible and visible. Even well-intended urban planning initiatives fall short of protecting biodiversity because broad qualitative gestures take the place of clear and quantitative policies that can effect real change. Inversely, the projects in this report are rare in their reckoning with this issue regardless of directive policy in their locations.

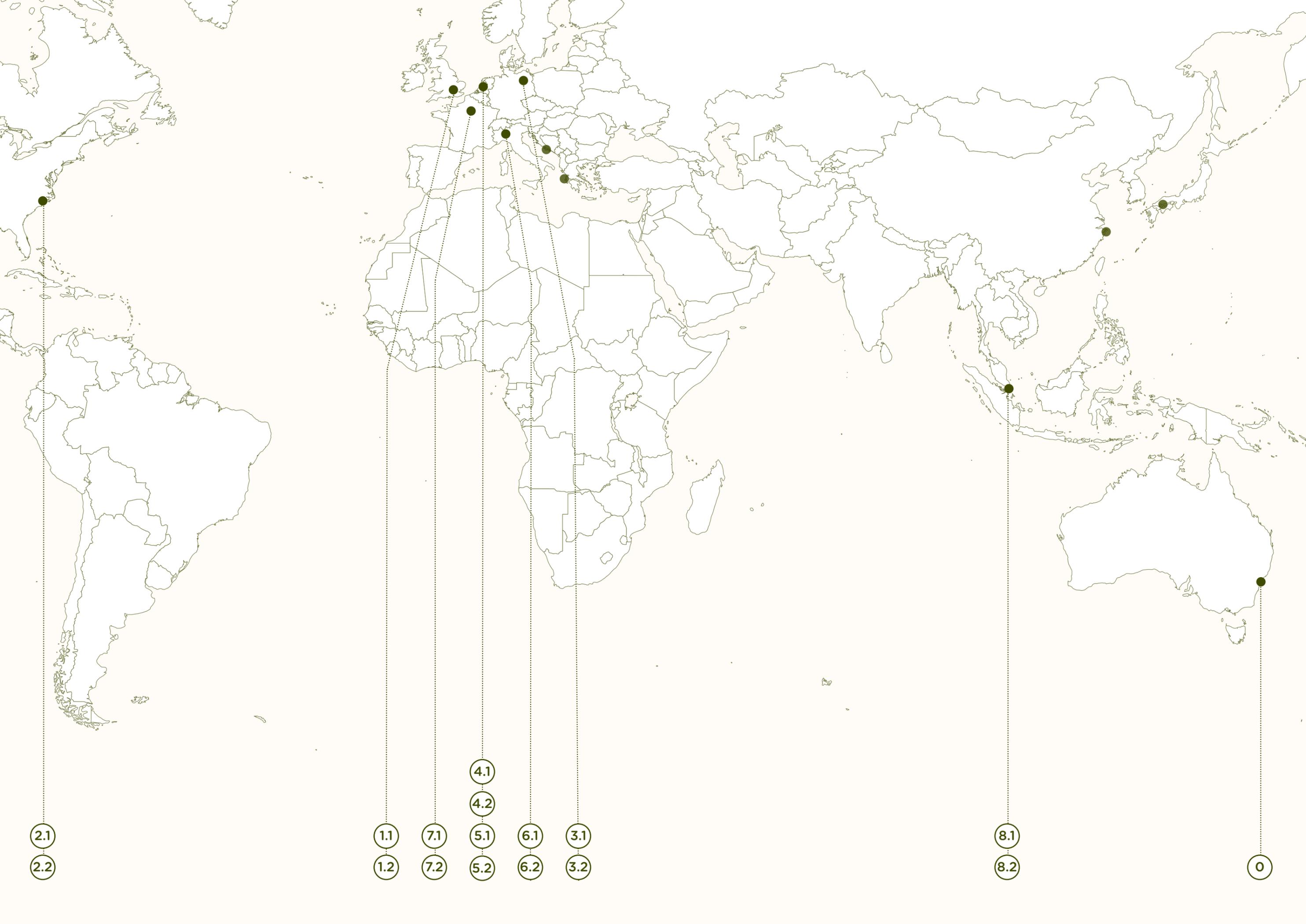
An ecological world-view is not finite or closed, but open, flowing and interconnected. It would be counter-intuitive to offer a decisive “conclusion” to this research, as its ambition was to illustrate and share practices from the complex fields of both architecture and ecology that are mutually beneficial.

Instead, a diagnosis of the ruptured relationship offers eighteen ‘tools’ that architecture can adopt in an effort toward a more reciprocal relationship with ecology, and cross-references each tool with the case studies from this research that demonstrate their practical application. Access to the transformation of architecture through these tools range from specific design detailing and project wide collaboration through to complex interactions with planning agencies and governmental bodies who determine urban legislation and policy.

The matrix operates as a fantasy league of ecological architecture all-stars, most effective in combination.

Free ground plane for landscapes & wetlands	i
Balance density with large open parkland	ii
Link disconnected landscapes with patches	iii
Balance native, introduced & naturalised species	iv
Reduce energy demand with passive systems	v
Urban ecology stimulates labour & economy	vi
Test space from initial idea by prototyping	vii
Maximise complexity of form for biodiversity	viii
Facilities for ecological education & engagement	ix
Occupy city rooftops as ecological territories	x
Localise energy and food production in cities	xi
Repurpose existing brownfields & infrastructure	xii
Plants filter contaminants and capture carbon	xiii
Architecture collects and processes water	xiv
Cyclical processes for material and waste	xv
Engage software, technology & automation	xvi

	Kew Botanic Gardens	The Barbican	Oystertecture	The High Line	Floating University	Prinzessengarten	Test Site Rotterdam	The Missing Link	Westerpark	De Ceuve	Bosco Verticale	Broken Nature	Ivry Sur Seine	Clichy Batignolles	Hortpark and Conservatories	SDE4
	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	6.1	6.2	7.1	7.2	8.1	8.2
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i. Free ground plane for landscapes & wetlands

The architectural project minimises its footprint on ground, securing space for structural footings and circulation cores as necessary but giving over as much footprint to waterways and deep-soil areas for large tree and plant species to proliferate and attract birds, insects and other animals as well as recreation space.

ii. Balance density with large open parkland

In the planning stages of neighbourhood, community or large scale developments, securing a centrally-located open park for recreation, water capture and storage as well as a diverse range of planted species together is beneficial and important both for cyclical energy systems as well as maximising carbon sequestration.



iii. Link disconnected landscapes with patches

Architectural structures are three-dimensional complex forms that can act as bridges and connections between disconnected adjacent ecological spaces like parks and waterways in urban environment. The facade, balconies, elevated platforms, rooftops, circulation spaces and ground landscaping can perform in this way. Beyond the architectural site, the same gesture applies to median strips, sidewalks, courtyards, plazas and infrastructure.

iv. Balance native, introduced and naturalised species in urban environments

As is the case with populations of humans migrating all over the planet for centuries, so too have complex migrations of 'native' seeds been transported beyond their original territories for food production or ecological benefit. Many introduced, not invasive, species grow well in urban conditions, are low maintenance and can improve their environment, creating contemporary urban ecosystems.

v. Reduce energy demand by using passive systems

This tool actually categorises spaces according to the duration of time they are occupied, for example a bedroom or a classroom are spaces in which people spend a lot of time and therefore should achieve maximum levels of comfort regarding air quality, temperature and humidity. On the other hand, circulation spaces, bathrooms, storage areas and spaces we spend only a short amount of time in or 'pass through' can be sheltered but open in many climates. These can be indoor-outdoor semi-controlled spaces, saving a great demand on energy systems.



vi. Urban Ecology stimulates labour & economy

A growing awareness of species disappearance, climate change, transition to renewable energy sources from fossil-fuels, carbon emissions and ecological breakdown brings about an entirely new position toward human labour that actually cares for natural systems of non-human species reproduction, especially in urban environments. The kinds of caretaking that can form part of a labour economy will expand on existing roles of horticulture, botany, volunteering, ecology and urban ecology toward ecological technology, sensing media, widescale bushcare, propagation facilities, seed banking and cultural facilities for learning and sharing.

vii. Test space from initial idea by prototyping

Although this tool applies to any architectural process where a change in the use of or interaction with space is proposed, this is specifically referring to the testing of what ecological conditions can work and thrive in certain urban conditions such as rooftops,

shaded walkways, narrow laneways, humid summer environments. The prototype phase can take place in the early planning and design for an architect, engaging with urban ecology to experiment with species.

viii. Maximise complexity of form for biodiversity

Architecture, especially of the modern variety, became accustomed to straight lines, surfaces, extrusions and hard, cold edges of steel, concrete and glass. Cities are full of such structures in the form of office towers. Architecture that welcomes ecology to its cityscape can undulate its external edges in mutually beneficial ways; creating a variety of landscape environments for humans and non-humans on external edges and, inversely, an interesting sequence of internal conditions.

ix. Facilities for ecological education/engagement

For architecture, this tool encourages familiar spaces including; seed banks, nurseries, herbariums, planetariums but it is also an invitation to imagine completely new typologies or to reimagine existing typologies in completely new ways for a future population almost certainly urban-focused. How can we grow food in the city? How can the community garden or farm be translated to tiny urban plots? How does an urban forest take form? What can grow on abandoned industrial sites? How can we use energy we throw away? Do we need to flush with potable water?

x. Occupy city rooftops as ecological territories

Every urban rooftop can be designed or transformed to host one or a combination of the following systems; 1. planted landscape with shallow soil and species for bird refuge, travelling bees, human recreation, 2. water collection and storage to be used for irrigation, flushing, washing, etc., 3. solar energy collection or 4. greenhouse or wintergarden spaces added to rooftops. This tool imagines the building as a living species itself that takes advantage of exposure to solar energy and surface area afforded by rooftops.

xi. Localise energy and food production in cities

Architecture structures should be responsible to localise the maximum amount of energy required to operate as well as take advantage of any opportunity to feed the species (yes, humans included) that inhabit them. Typologically, there is an opportunity for entirely new architectural spaces in the emerging field of stem-cell produced meat products that can be raised locally in urban environments, but also simpler methods of food production in the form of terrace or rooftop gardens.

xii. Repurpose existing brownfields/infrastructure

Save the need to intervene in existing greenfield sites at the city's periphery by creatively intervening in existing brownfield sites and reimagining the way they contribute to their environment in a post-industrial contemporary context. Those peripheral landscapes, though they exist often out of sight, are often precious swathes of biodiversity with complex soil structure that allow the city air to remain clean for they sequester carbon.

xiii. Plants filter contaminants and capture carbon

Moving beyond fashionable, corporate trends for 'green architecture' that privilege the aesthetic or emotional human tendency toward plants as objective matter, this tool invites architects and their project teams to engage with plants as environmental engineers that operate with ancient and incredibly intelligent systems of energy production, storage, reproduction, reciprocity, carbon sequestration, air filtering, phyto-remediation and habitat creation.

xiv. Architecture collects and processes water

Australia has a low annual rainfall anyway but over this last summer (2019-2020) as bushfires raged

through the south-eastern landscapes of the country while the north-eastern ones flooded, the environment clearly demonstrates the need to engage in more



responsible methods of water collection, dissemination, filtering and reuse. In Australia, we flush our toilets with potable (drinking) water. This tool calls for the intermediary scale of architecture to be creative in how hydraulic systems are creatively engineered to save and recycle water depending on its use; potable, grey or black.

xv. Cyclical processes for material and waste

If we can consider architecture as part of a living ecosystem then the materials we from must be considered, taking into account; the impact on ecosystems of the production of construction materials, the lifespan of a material and what will happen in demolition (calculating carbon returning to the atmosphere), the potential use of self-generative materials such as mycelium as well as ecosystems themselves as an environment (can we spend less time in controlled interiors working and more time outside?). Trash cans inside buildings are collected and redistributed beyond cities to be burned or dumped in landfill. In the best case, waste is recycled for reuse or composted. The building itself should minimise reliance on the first two options and instead integrate systems of the second two.

xvi. Engage software, technology & automation

GIS mapping systems that store large amounts of interactive data on species, territories, populations and climates as well as mobile technologies in the forms of interactive apps are changing the way we engage with the world around us. These innovations can be built into architecture in the way people control their comfort, energy use, food production and waste as is the case with the Learning Trail at SDE4. These technologies expand the potential to protect and understand what species require in urban environments for survival, as well as to prototype creative solutions.



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About the Author

Eleanor Peres is from Hobart, Tasmania where a youth spent nestled between the Derwent River and Kunanyi Mountain instilled in her a wondrous appreciation for the diverse species, landscapes and territories of earth. This curiosity extends to Eleanor's practice in design and architecture.

A lover of exploration, Eleanor has spent time living and working in regional Ontario, Rotterdam and Tokyo with design studios Kengo Kuma and Associates and Zones Urbaines Sensibles. In January 2020, Eleanor will relocate to Moscow, Russia to study the Terraforming at the Strelka Institute for Design, Architecture and Media.

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In a media atmosphere that suggests the future might be cancelled due to rising surface temperatures of earth, global emissions, climate and biodiversity crisis, Eleanor is engaged in exploring what design might offer. She is the creative director of the multidisciplinary platform mone (museum of native ecology) that looks outward to the world from the perspective of design as a creative method to imagine a reciprocal future.



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