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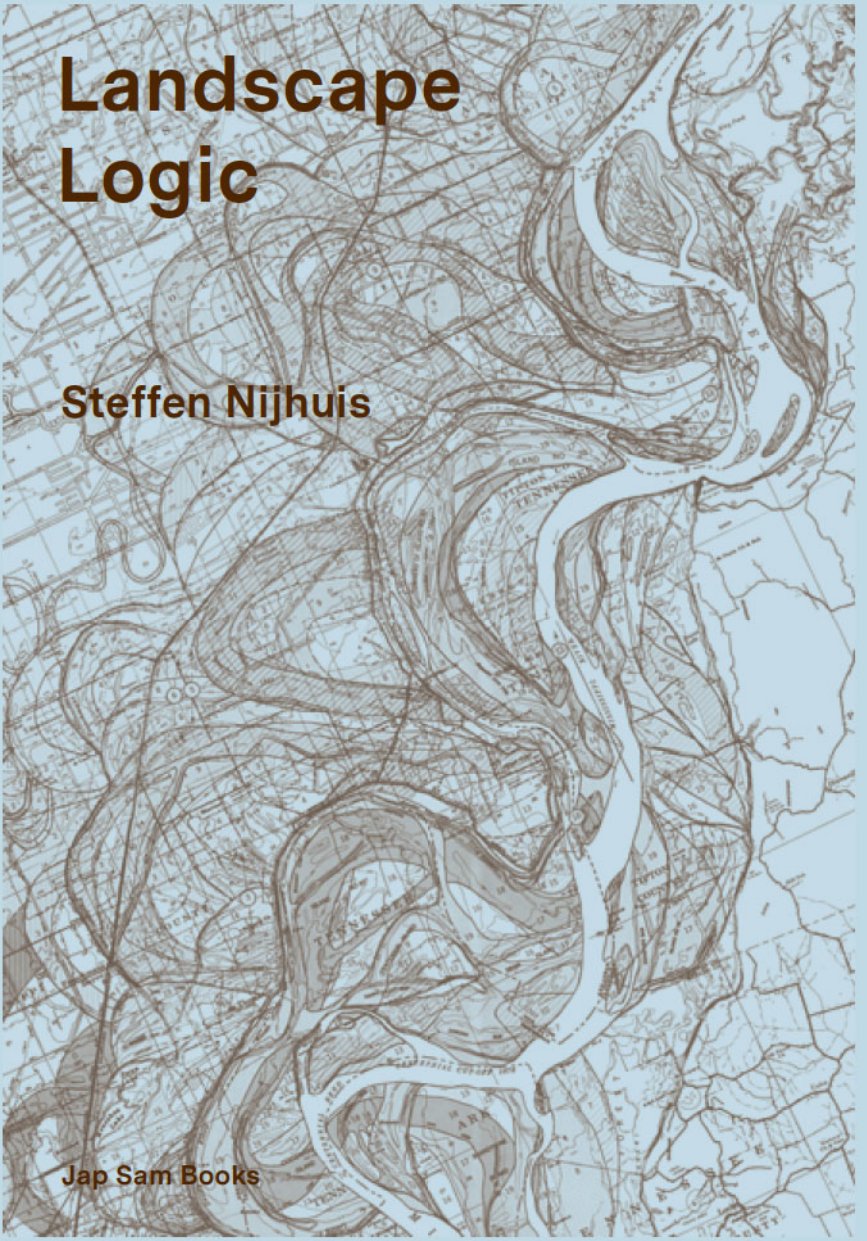

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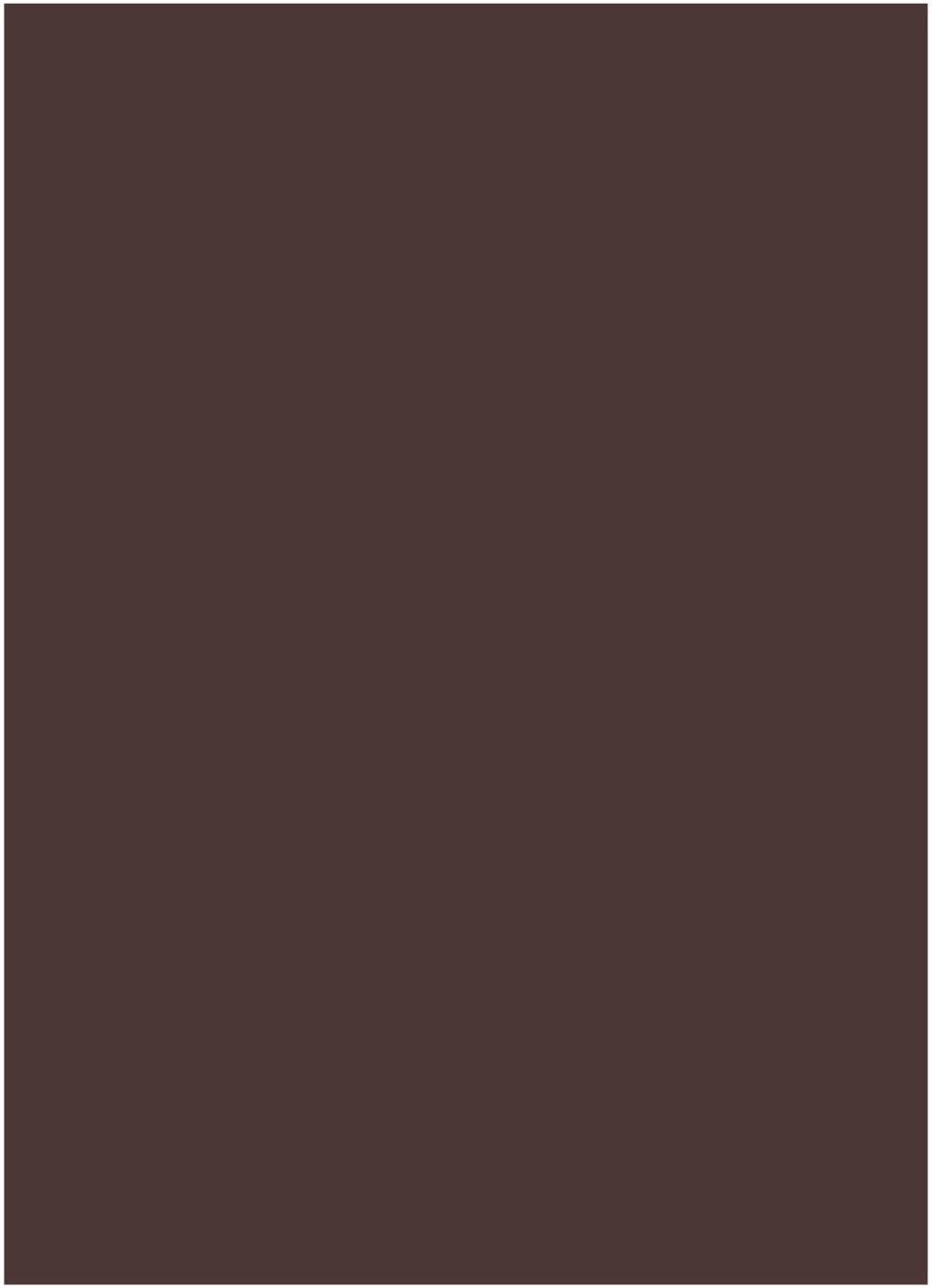


Landscape Logic

An essay on the need for a landscape-based approach to designing sustainable urban environments

Landscape Logic

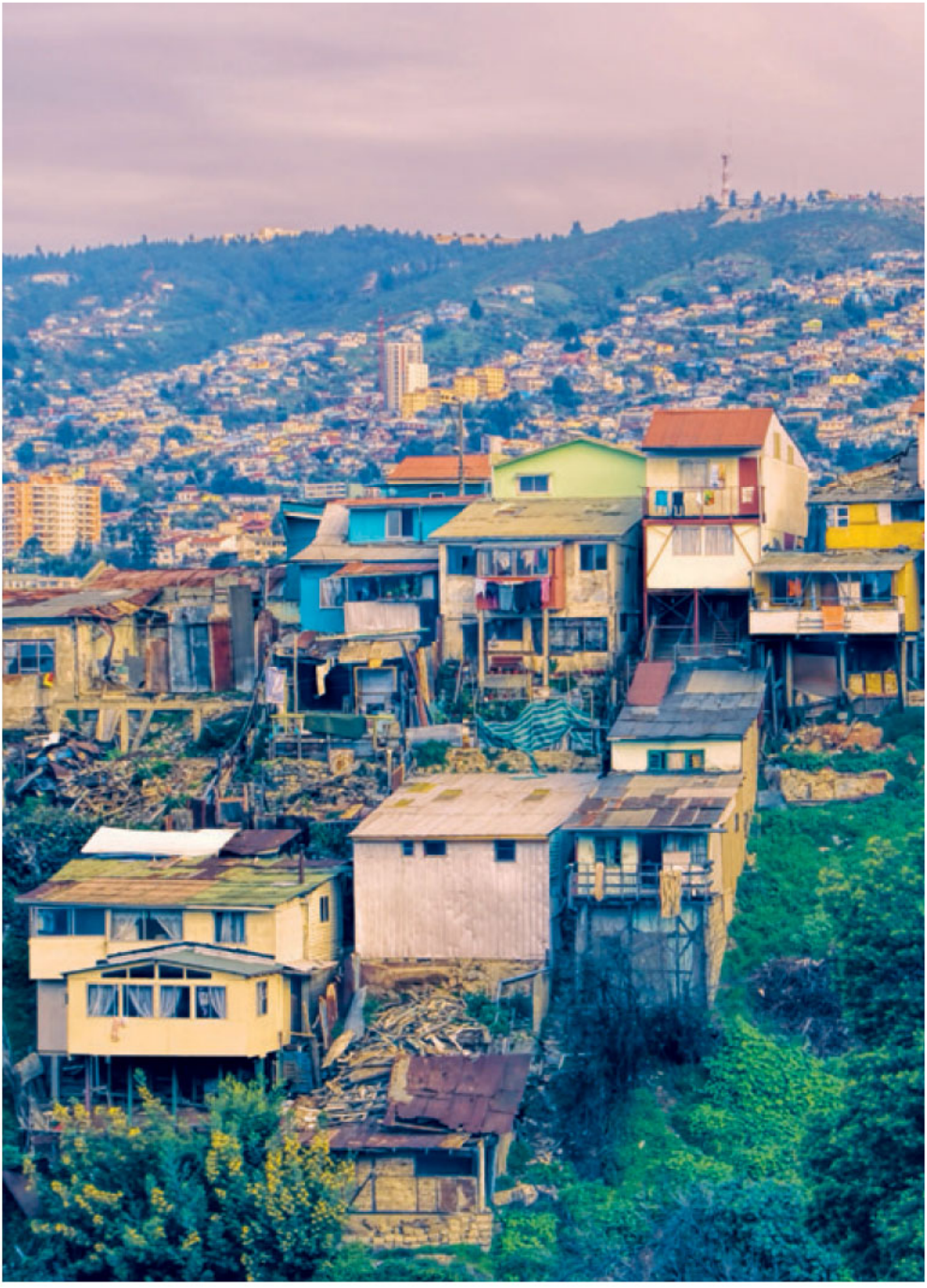
Steffen Nijhuis

Jap Sam Books

land·scape:
'an area, as perceived
by people, whose
character is determined
by natural and/or human
factors and the interaction
between them'

lo·gic:
'a way of thinking
and reasoning'

Contents



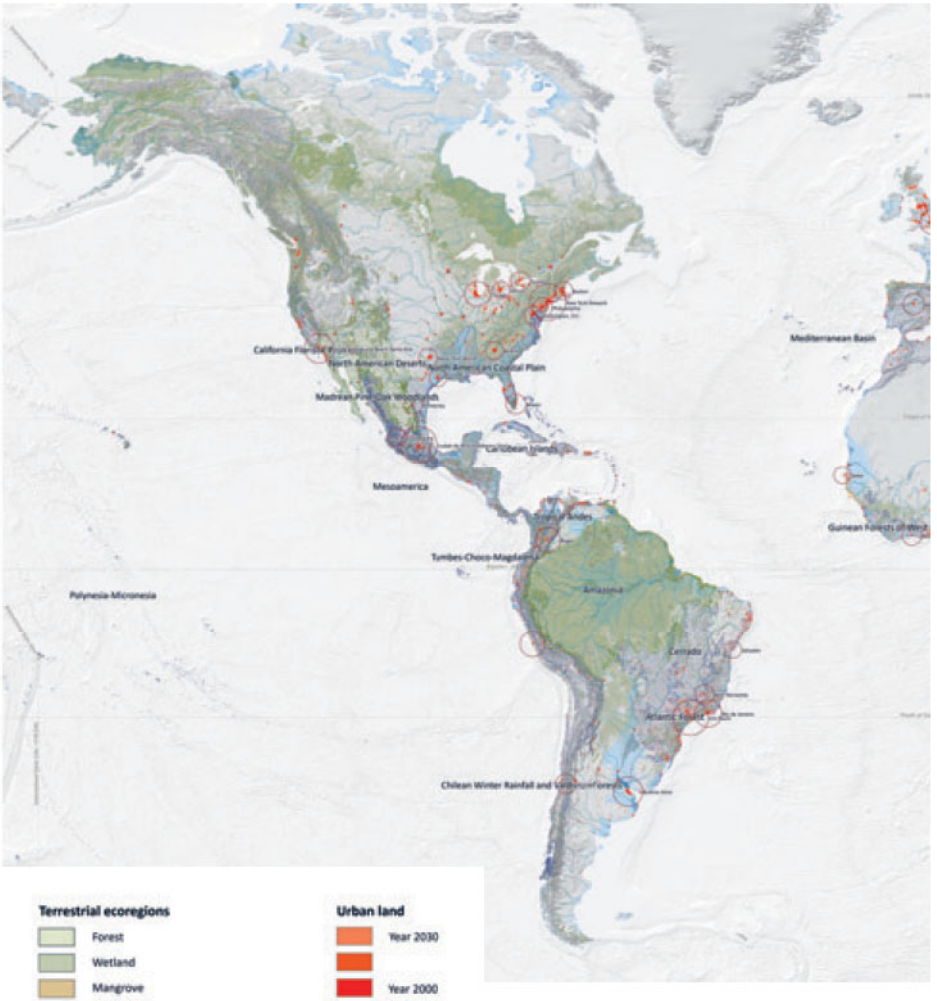
1 Landscape for Sustainable Urbanisation

Informal urbanisation replacing precious ecosystems in Brazil (Photo: Michael Knitl/ Alamy Stock Photo)

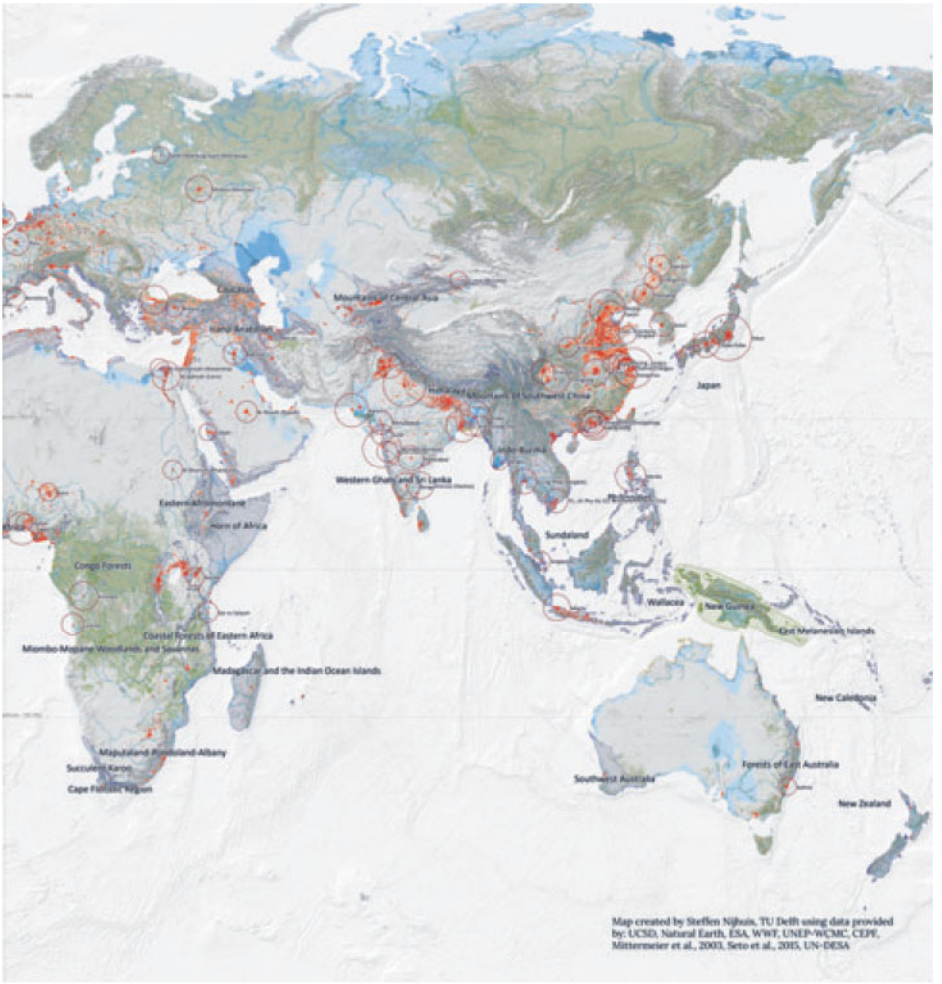
Landscape logic refers to a way of thinking and reasoning in which the landscape takes centre stage. It refers to an approach in which understanding the system of the landscape and the related natural and socio-cultural processes form the basis for designing future-proof urban environments; from region to back garden. Designing with nature, humans, and history forms the core of the approach. Using landscape logic, we can make plans for the future, based on insight into what already exists. We can then critically judge ideas and designs and make well-informed choices. By analysing a situation, one arrives at a logical, sensible decision. Why do we need landscape logic for the built environment?

Biodiversity and urbanisation

Alongside the loss of biodiversity, increasing inequality, and climate change, urbanisation is one of the biggest challenges of this century. It is expected that 68% of the world's population will live in urban areas by 2050. Due to population growth and migration to cities in the hope of a better life, an additional 2.5 billion people will move to the city.[1] Furthermore, cities will become 2 to 3.5 times larger than they are now, which is especially visible in parts of Asia,



Projection of urban development in 2050, at the expense of vulnerable nature areas
(Image: Steffen Nijhuis, TU Delft)


Caucasus
Mountains of Central Asia
Japan
Western Ghats and Sri Lanka
Eastern Afromontane
Horn of Africa
Sundaland
Wallacea
New Guinea
East Melanesian Islands
Congo Forests
Coastal Forests of Eastern Africa
Miombo-Mopane Woodlands and Savannas
Madagascar and the Indian Ocean Islands
New Caledonia
Mapulaland-Pondoland-Albany
Succulent Karoo
Cape Floristic Region
Southwest Australia
Forests of East Australia
New Zealand
Map created by Steffen Nijhuis, TU Delft using data provided by: UCSD, Natural Earth, ESA, WWF, UNEP-WCMC, CEPF, Mittermeier et al., 2003, Seto et al., 2015, UN-DESA

Europe and America.[2] In the Netherlands, too, around 1 million extra houses need to be built in the coming years. All this urbanisation is at the expense of vulnerable nature areas that protect us and provide us with water and food.

Since 1970, biodiversity has declined by 68% worldwide.[3] Changing land use is one the main causes of this. Every year, an area as big as Germany is deforested. For example, in Brazil, parts of the Atlantic Rainforest, one of the most biodiverse regions in the world, with thousands of species of birds, animals and plants, are rapidly being replaced by informal urbanisation. This despite the fact that 30% of the people of South America are dependent on water from the Atlantic Rainforest. This is illustrative of what is happening in other biodiversity hotspots on Earth.[4]

Marshlands are the habitat of around 40% of all animal species.[5] Reed marshes, salt marshes, mangroves, and peatlands can be found across the world and are of vital importance, also for humans. These areas filter and purify polluted water, provide a livelihood and protection against floods. Despite all these values, marshlands are disappearing even three times faster than the forests mentioned earlier. In Florida for example, where mangroves are making way for luxurious residential areas every day. This has huge consequences for the stabilisation of the coastline, flood reduction, and fishery.

Because people live along the coast, around 800 million people will be at risk due to the consequences of the rising sea level, floods, and storm tides by 2050.[6] As Dorthe Nors so powerfully puts it in her book *A Line in the World*: *'… those who live by the water live under its constant threat …'*[7] In other words, be prepared for water when you go and live near water. This truth becomes clear in low-lying urban regions, where people are regularly confronted with floods due to heavy rainfall, the river, and the sea. We are familiar with this in the Netherlands, but it is also frequently experienced in the fastest-urbanising delta of the world, the Pearl River Delta in South China, an area half the size of the Netherlands, but with 60 million inhabitants.

Natural solutions

At the same time, there are also projects where nature is used as a solution for societal challenges. When we talk about nature, we mean everything, abiotic or biotic, that exists and maintains itself without human intervention. For example, solutions based on nature – also called 'nature-based solutions' or 'eco-engineering' – can be used to make coastal areas safe again. Ecosystems like marshes, mangroves and coral reefs are restored to mitigate risks relating to the rising sea level. These ecosystems are even able to grow along with a sea-level rise of 0.5 to 1 cm per year.[8] Therefore, mangroves are restored in partnership with the local population in Indonesia and other countries, as a natural coastal defence. Traditional, local knowledge is not only used to make the coast safer, but also to help marginalised population groups to earn a living by means of aquatic agriculture and fishery, which can take place in the new, varied transition zones between land and water.

There are also inspiring examples of how green-blue networks and urban agriculture steer urban development in the right direction by providing so-called green infrastructure, which offers us all kinds of services. Providing

Mangrove restoration in partnership with the local population in Indonesia (Photo: Jake Lyell/ Alamy Stock Photo)

food for the local population, as we can see in Havana. But also retaining water, providing cooling, and capturing CO_2. And, importantly, the contribution to the physical and mental health of urban residents. Other examples of nature-based solutions are biobased building, freshwater storage, and natural water purification.

Nature and landscape as a basis

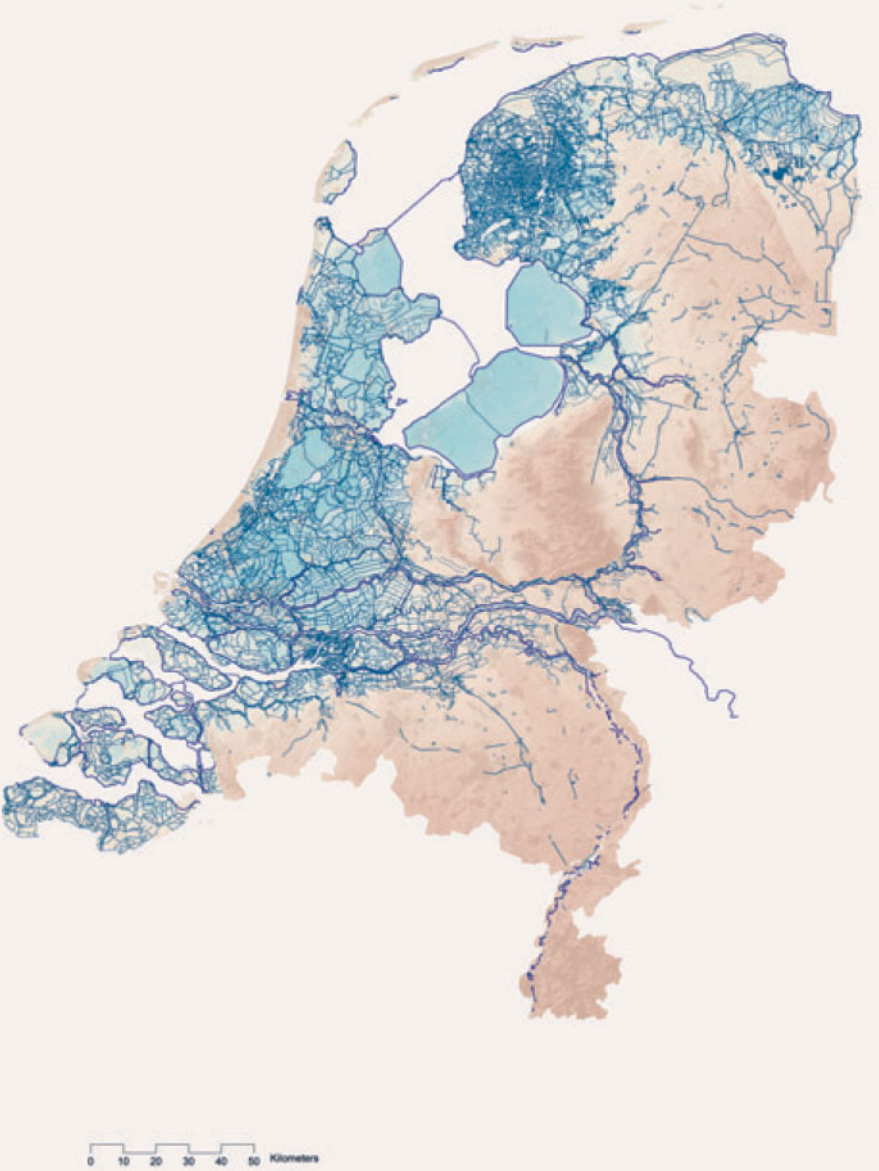
According to the Brundtland Commission, sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.[9] To develop this further, the 2030 Agenda for Sustainable Development was launched in 2015. This agenda provides a globally shared framework for sustainable development, expressed in seventeen Sustainable Development Goals (SDGs).[10] These SDGs recognise that the elimination of poverty and other hardships has to go hand in hand with strategies for developing sustainable cities and communities, in order to improve health and education, reduce inequality, and encourage economic growth – and all this while tackling climate change and working to preserve our oceans and forests.

Landscape at the basis of sustainable change (Image: Azote Images for Stockholm Resilience Centre, Stockholm University)

In order to avert the negative consequences of urbanisation and contribute to sustainable urban development, an approach is needed that considers the biosphere as the context for social and economic development. This is aptly visualised in the so-called wedding cake model, developed by the Stockholm Resilience Centre, in which the seventeen sustainability goals have been ordered hierarchically. Here, the economy is not taken as a point of departure, and, instead, nature and humans – the landscape – are at the basis of sustainable change.

In order to concretise this sustainability ranking model, it is necessary to develop and apply planning and design strategies that take landscape as the basis for working with natural processes for the benefit of socially and ecologically inclusive and flourishing urban landscapes. To put SDGs into practice in the field of sustainable urban development, we not just have to design cities in a different way. We also have to train future generations of professionals and scientists who are able to put nature and landscape centre stage in urbanisation issues and to come up with innovative and creative solutions. Therefore, the call for the landscape architect, as Cleijndert put it as early as 1925, is louder than ever before.[11] In landscape architecture, as a design-oriented academic discipline, principles of the natural, social and technological sciences, and of course the arts, are applied to the design and preservation of natural, cultural and urban landscapes. Therefore, landscape architects are uniquely qualified to contribute to a *sustainable*, *liveable and attractive environment for everyone*: *humans*, *plants and animals*.

1 United Nations 2019.
2 UN-Habitat 2016.
3 Almond et al. 2020; Diaz et al. 2019.
4 Mittermeier et al. 2004; Molnar 2010.
5 Hoekstra et al. 2010.
6 World Economic Forum 2019.
7 Nors 2022, p. 99.
8 IPPC 2019.
9 Brundtland 1987, p. 8.
10 United Nations 2015.
11 Cleijndert 1925.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2 Landscape

Dutch polder landscape, which has been shaped over the centuries by surveyors, monks and engineers (Image: Steffen Nijhuis & Michiel Pouderoijen, TU Delft)

Landscape plays a central role in this argument. But what exactly is landscape? Landscape as we see it is the result of the activity of natural and human factors and the interaction between them.[12] We can therefore understand landscape as an image, how we as humans perceive and value it, but also as a pattern, the spatial mosaic of types of land, units of soil and vegetation, and land use. Together, they form a complex and living (eco)system that has emerged from the interaction of relief, soil, water, climate, flora, fauna and human intervention. So, landscape is not just nature or greenery, but also culture, as humans play an important role in its formation. This is clearly visible in the Dutch polder landscape, which has been shaped over the centuries by surveyors, monks and engineers.[13] It shows that people have adapted themselves to the natural context and have made new landscapes for centuries. We actually have a large diversity of landscapes in the Netherlands: the landscape of the old sand reclamations, the sea clay reclamations with artificial dwelling mounds (so-called *terpen*), the peatland reclamations of the west of the Netherlands, or polders such as the seventeenth-century Beemster in the province of Noord-Holland, to mention only a few examples.[14]

Landscape values

pp. 16–17
Typical small-scale landscape in the Achterhoek region of the Netherlands
(Photo: Wirestock, Inc./ Alamy Stock Photo)

The landscape, as a connection between nature and culture, represents all kinds of values relating to ecology, aesthetics, social aspects, and the economy. According to the Millennium Ecosystem Assessment, the (natural) landscape provides structure and contains and offers many supporting, cultural, provisioning and regulating services.[15] These ecosystem services play a crucial and valuable role in biodiversity, human health, nutrition and habitation, but also in the functioning of our economies.[16] Human wellbeing is therefore strongly dependent on the services that nature and the landscape provide.[17]

Landscape-based solutions often have a cost-saving and value-increasing effect, as various studies show. The landscape as natural infrastructure saves billions per year in combating climate crises, and is around half as expensive as standard infrastructure.[18] For example: natural landscape infrastructure helps to reduce the demand for energy and can be used for energy production, it is a critical factor for water retention and freshwater provision, and also provides powerful means for flood protection and coastal safety from the point of view of climate resilience and adaptation. Climate adaptation refers to the process of adaptation to actual or expected changes and their consequences, in order to moderate harm due to climate change or to exploit beneficial opportunities.[19] Landscape can then be used for: [1] adaptation based on nature or ecosystems: the use of biodiversity and ecosystem services as part of a general strategy to adapt to the harmful consequences of climate change, [2] adaptation of the built environment: adaptive solutions with regard to water safety infrastructure, such as multifunctional climate dykes along coasts and rivers, and [3] socio-institutional adaptation: adaptative measures within social, administrative and economic systems and sectors, to become more resilient as a society and generate solutions.[20] This landscape-based adaptation can take place in an evolutionary or incremental way.

Landscapes are also often highly appreciated for their spatial qualities: enjoying the vastness of the polders or the small-scale character of the Achterhoek region (NL), on foot or by bike. Landscape is often saturated with beautiful memories. Looking for shark teeth on the beaches of the province of Zeeland, a marriage proposal in the forest landscape of the Gooi region, enjoying the setting sun that turns the ditches of the peat meadow landscape into golden lines. It is no coincidence that artists such as Henk Chabot felt the landscape by painting it, so to speak.[21] For example, he presents the grandeur of the universe as the sky above the low-lying polders on the edge of Rotterdam. The cultivated earth is depicted as houses that seem to have been built by a child, haystacks, telegraph poles, etcetera. So, landscape is also emotion.[22]

Artists such as Henk Chabot felt the landscape by painting it (Image: Collection Chabot Museum Rotterdam, donation of photo archive Chabot estate)

Concerns about landscape

It will come as no surprise that 81% of the Dutch population is concerned about the landscape, especially in areas where urban pressure is large.[23] Although it is evidently highly important in many people's lives, landscape is still often experienced unconsciously and seen as a background. Or, when it comes to spatial challenges that are related to climate change or the energy transition, the role of the landscape usually remains implicit, or it is blindly assumed that it is part of something we call *spatial quality*. Another example is the current policy concept 'soil and water are guiding'. In itself, this is obviously a positive development, but what is the point if we do not use it for landscape formation? These are examples of sectoral approaches and scientific silos in which specialisation of knowledge comes at the expense of integral solutions. Often, a long-term vision is also lacking, a regional spatial perspective that is needed to guarantee coherence and to steer local developments in the right direction.

It causes our landscape to become uniform, to be organised efficiently, without space for change or a personal touch. Apart from the loss of vulnerable nature, urbanisation in all its forms contributes to the fragmentation of the habitats of humans and animals. Fragmentation by infrastructure, disconnected developments that are inward-looking and often have hard borders that make exchange between areas impossible for humans and animals. Due to fragmentation

Biotic homogenisation caused by the application of standardised solutions for greening the city (Photo: JG Photography/ Alamy Stock Photo)

of the landscape, the remaining natural habitats become smaller, leading to loss of species. Ironically, well-intended local solutions often also cause problems, because they are disconnected from other solutions and lead to fragmentation on a regional scale. Thus, solutions at certain levels of scale result in problems at higher or lower levels of scale. In order to prevent this *paradox of scale*, it is necessary to work and think across scales.[24]

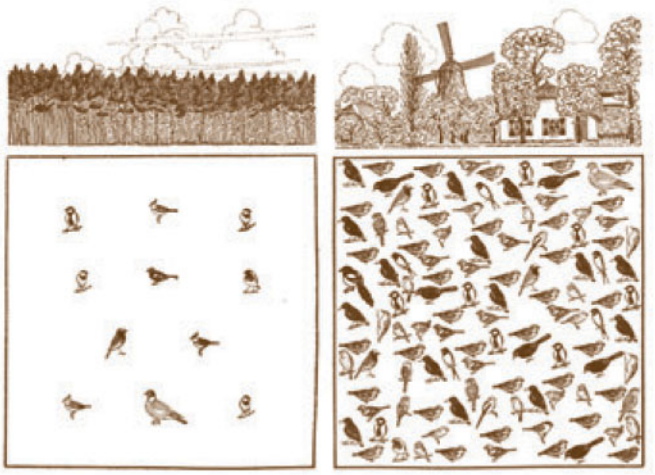
Landscape blindness and landscape amnesia

Landscape is often treated in an abstract way, as something that serves as a background, a sum of 'solutions', causing landscapes to become monofunctional and monotonous. It is a form of *landscape blindness*, in which the diversity in the landscape is overlooked and not valued for the functions that it fulfils for us.[25] Because changes often take place gradually, we do not always notice this immediately, especially when nature is concerned. This blindness to change has to do with the human inability to record and transmit changes in nature.[26] This has huge consequences for the future. Knowledge of the richness of nature and landscape is at risk of disappearing from our collective consciousness and being forgotten: *landscape amnesia*. This phenomenon can be linked to the *shifting baseline syndrome*, a psychological and sociological phenomenon in which every new generation of humans accept the situation in which they have grown up as natural or normal.[27] Nowadays, young people grow up in a situation that for them is the frame of reference for the future. A landscape as a sum of snippets of nature, housing, industrial estates, infrastructure and hard borders.

Monotony is not just the result of urbanisation processes, but also of the application of standardised technological solutions for water safety and food supply that are in themselves well-intended, but at the same time bypass the opportunities the landscape provides. This is also true of the greening of urban space. Greenery is often treated in an abstract way, as something that only consists of a number of square metres, without having a relationship with the landscape or without creating landscape. Due to the lack

of a vision that is aligned with the landscape, people often resort to schematic, artificial ordering, which leads to stereotypes. This is partly the reason why identical solutions can be seen everywhere. The same species of trees and other plants are used unthinkingly, causing genetic impoverishment and biotic homogenisation. Grass and lawns have a large impact on biodiversity and make the ecological system vulnerable. As mentioned above, much of the diversity is lost, and thus also the resilience and adaptive capability that are so urgently required to make our living environment future-proof. If the resilience of the landscape is not given more attention, the risk of damage and destruction of capital increases.[28]

In order to turn the tide, it is necessary to actively protect nature and landscape, to continue the traditions of nature and landscape conservation that have manifested themselves in the Netherlands since 1900, and to revive nature and landscape policies from the 1990s.[29] Conservation of biodiversity has long been focused on 'unspoiled nature', without attention for urban habitats and boundary areas.



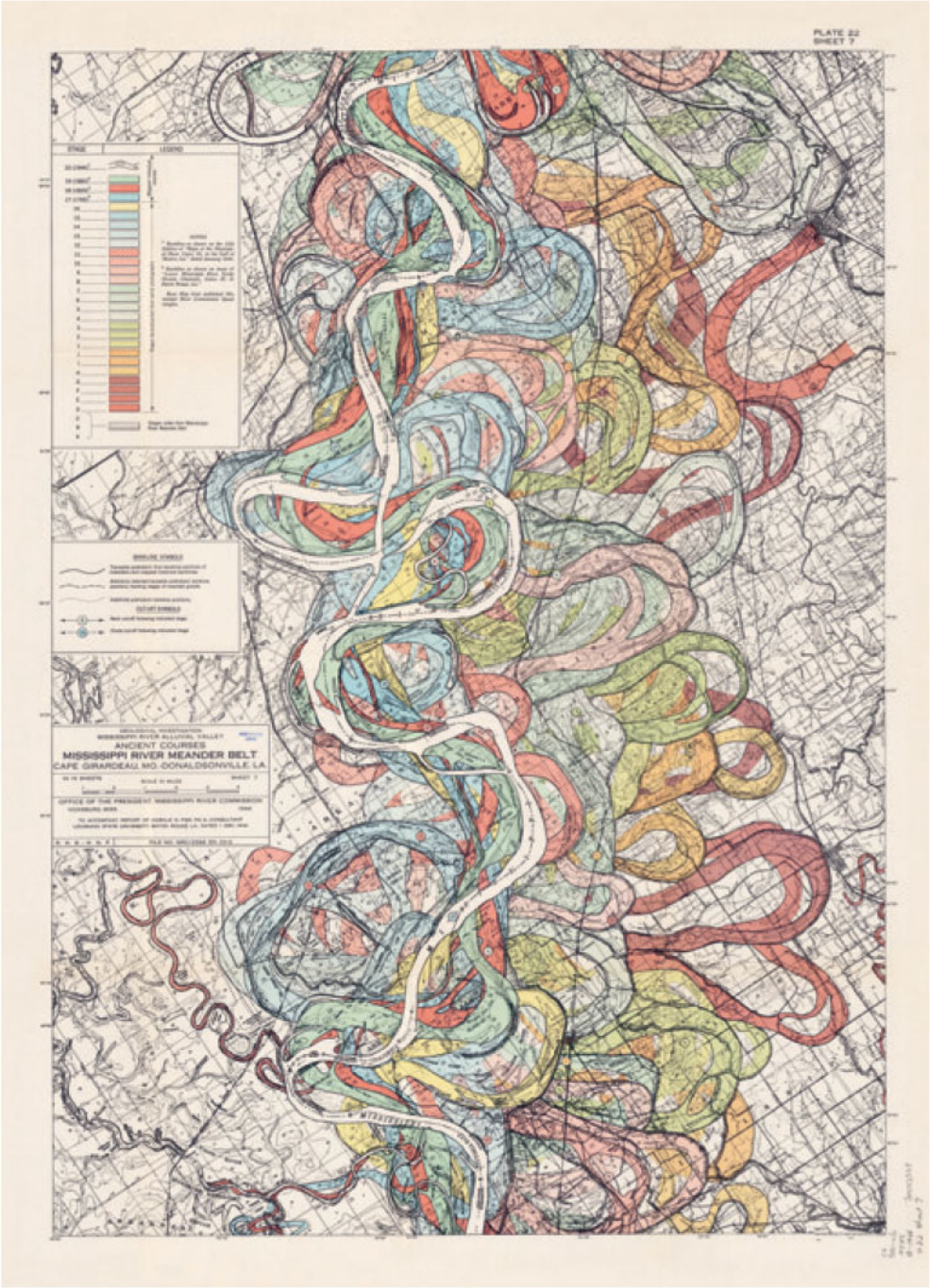
Urban areas (right) are often richer in species than pastures and production forests (left) (Source: Tinbergen 1943)

We now know that these areas can be highly beneficial to nature, even though they do not look like conventional nature. For instance, urban areas are often richer in species than pastures and production forests. Birds and other animals find a suitable and varied habitat in the urban environment, depending on the type of buildings and the amount of plants.[30] In addition to conservation, we also have to prevent alienation from nature and landscape through nature education and increasing the interest of the general public through attractive publications, documentaries etcetera. In other words, to inspire people of all ages to practise 'landscape sport', experiencing and learning to recognise landscapes and their natural and cultural diversity.[31]

It is therefore high time to put landscape centre stage again in spatial planning and policies, and to use landscape logic to create an attractive living environment for people and nature. Landscape connects people, themes and scales, and can be used as a perspective for urban development, as will be explained further on.

12 Zonneveld 1995, p. 4.
13 Nijhuis & Pouderoijen 2013; Steenbergen et al. 2009.
14 Bijhouwer 1971, 1977; Visscher 1975.
15 Millennium Ecosystem Assessment 2005.
16 Kumar et al. 2010.
17 Alcamo 2003.
18 IISD & UN-IDO 2021.
19 IPPC 2019.
20 Idem.
21 Bakker 2012.
22 Cf. Lemaire 1970.
23 Buijs et al. 2019.
24 De Jong 2007.
25 Cf. Wandersee & Schussler 1999.
26 Pauly 1995; Papworth et al. 2009.
27 Idem.
28 Hamers et al. 2021.
29 LNV 1990, 1992.
30 Kwak & Louwe Kooijmans 2021.
31 By analogy with what the conservationists and educators Eli Heimans and Jac Thijsse so aptly called 'nature sport' from 1896 onwards.

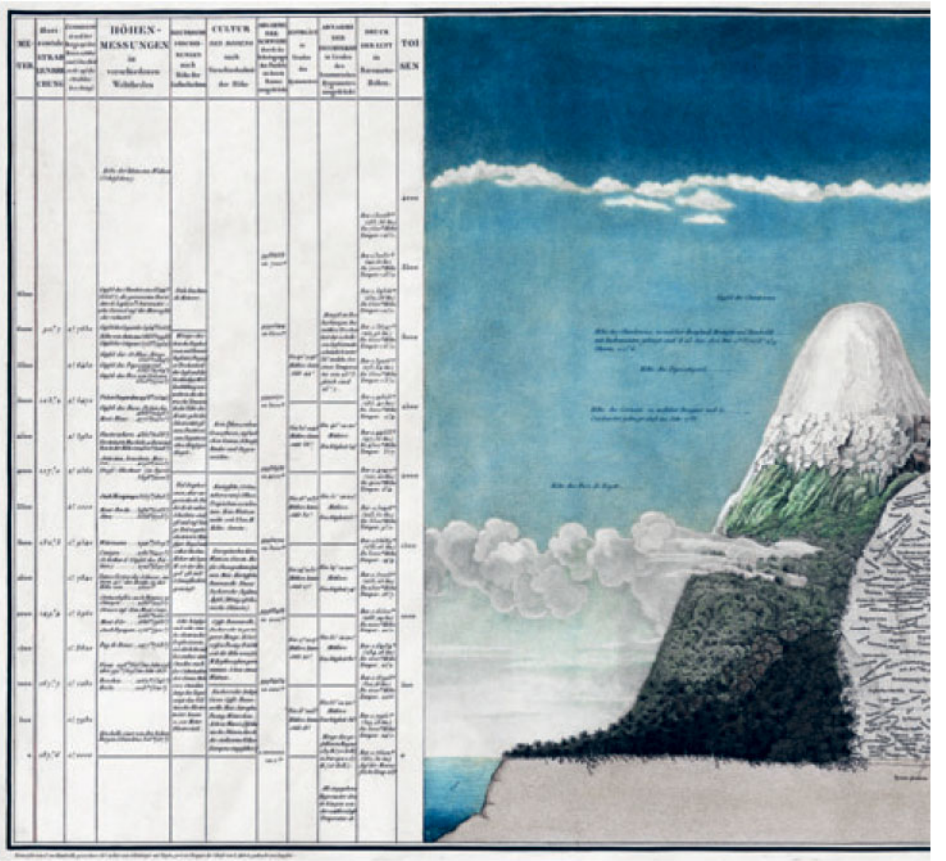
PLATE 22
SHEET 7



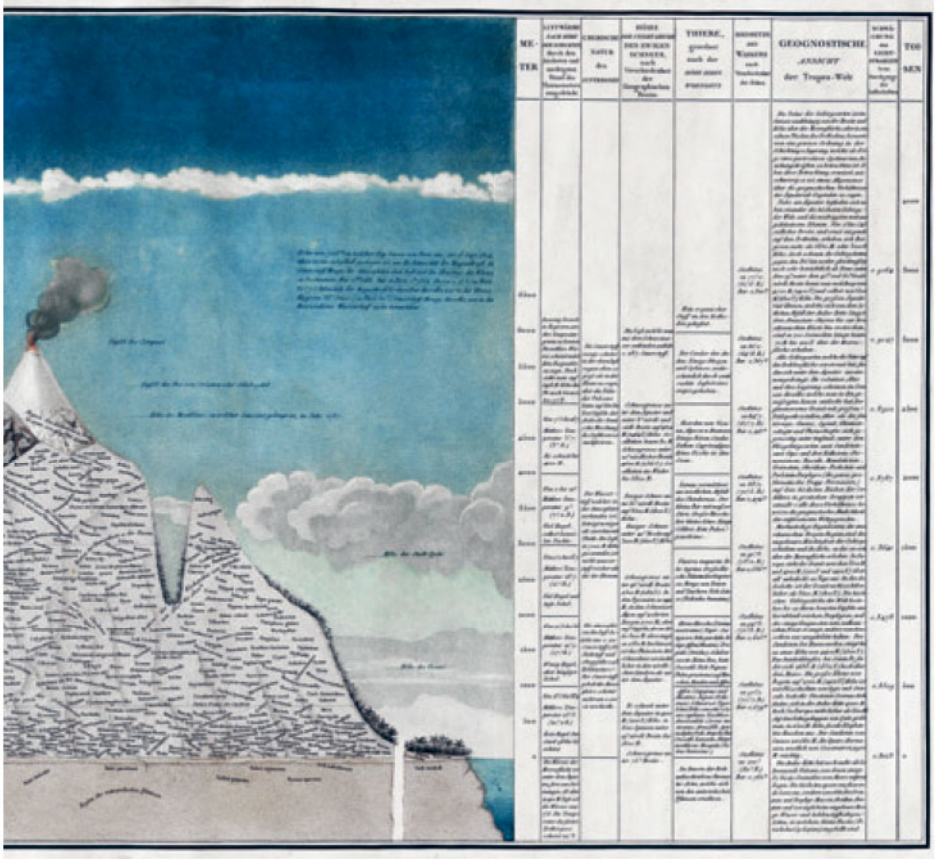
3 Landscape Logic

Mapping the change of a stretch of the Mississippi River, USA
(Source: Fisk, 1944)

The Prussian naturalist and explorer Alexander von Humboldt was among the first to recognise and develop a logic of landscape. In his *Ideen zu einer Geographie der Pflanzen* from 1807, he describes and documents the interconnection between abiotic factors – such as climate, relief, soil, water – and biotic factors, such as vegetation, animals, and humans.[32] He went through a thought process, step by step, and discovered relationships and connections between climate and plants, humans and their natural context. If we analyse his work, we find that he developed a landscape logic that was based on a threefold cognitive scheme. For him, landscape logic started with an impression of the landscape (*Eindruck*), followed by insight through analysis (*Einsicht*), through which the interconnections in the landscape system become clear (*Zusammenhang*).[33] In doing so, he used maps, cross-sections and diagrams to think visually. By drawing, he explored the diversity and interconnections. He came to the conclusion that landscapes are complex and living ecological systems that have a logical relationship.



Revealing landscape logic by mapping the interconnection between abiotic and biotic factors. Mapping of Chimborazo by Alexander von Humboldt in 1807
(Image: Science History Images/ Alamy Stock Photo)


METER
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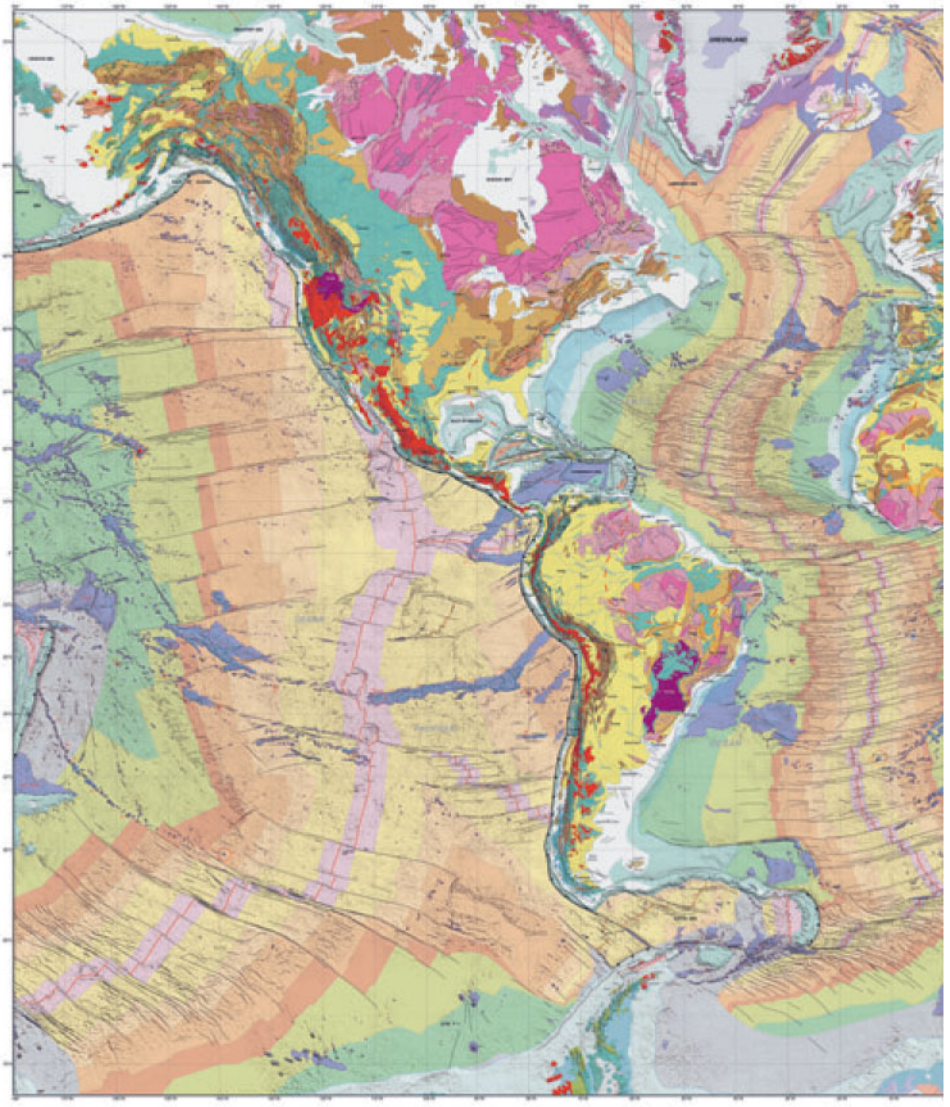
Logical relationships

We recognise landscape logic in the interaction between relief, soil and water. This becomes clear when we look at the so-called red-blue maps made by Von Frijtag Drabbe in the period 1945–1952, based on aerial photographs from the Second World War, a period of inadequate water management. He made the landscape logic visible by colouring the wetter parts of the landscape blue and the drier parts red.[34] He did so by means of the interpretation of aerial photographs, and he documented which parts of the landscape became wetter or drier. By doing so, he provided insight into the way in which variations in altitude, soil conditions, and vegetation influenced hydrological conditions.

Landscape logic also becomes clear when we look at vegetation patterns. Natural plant communities – characteristic groups of plants in a vegetation – are the result of certain

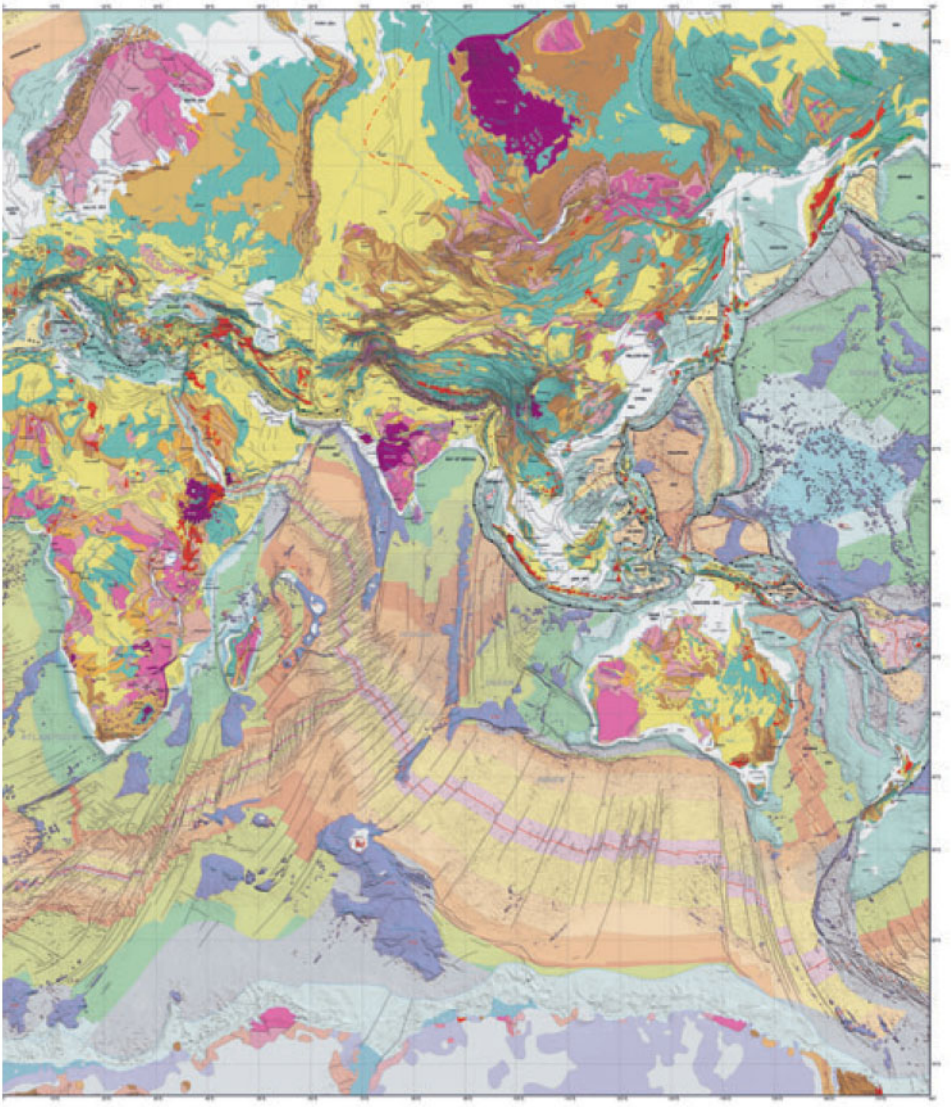
Natural vegetation as an expression of abiotic conditions. Visualisation of the habitus and root system of a *Quercus robur* (Image: Lore Kutschera & Erwin Lichtenegger, 2002)

Red-blue map of the Netherlands made by Von Frijtag Drabbe in the period 1945–1952, based on aerial photographs from the Second World War, a period of inadequate water management (Maps compiled by Steffen Nijhuis, TU Delft)



Geological map of the world showing the regional geodiversity

(Image: P. Bouysse et al., *Geological Map of the World at 1:35M*, CCGM-CGMW, 2020)



environmental factors, such as soil type, degree of acidity, amount of nutrients, hydrological conditions, land use and management. Therefore, vegetation is an expression of what is going on in the soil.

Landscape logic is also visible when we map the development of a river system over time, as was done by the geologist Harold Fisk for the Mississippi in America.[35] Fluctuations in water supply, sedimentation and erosion result in a living landscape. This illustrates that landscapes are dynamic systems, consisting of structures and processes that change over time.

Landscape logic is determined by geodiversity and climate. Usually, these are also reflected in traditional local architecture and the materials used for buildings, and in the structure of villages and cities.[36] The available materials, whether stone, wood or other materials, determine how and what one can build, how one provides coolness or warmth. The landscape context is also highly important for the positioning and orientation of buildings, cities and agricultural lands, as recorded by the Roman architect Vitruvius in his standard work *De Architectura*, and which we can also find in the work *De Re Rustica* by the Roman agronomist Columella.[37] We find similar ideas in Eastern Feng Shui principles.[38] The prevailing wind direction, sun and shadow, not too high and not too low in the landscape. In short, places where enough water and food was available; where people could live safely and healthily; and easily accessible. For our ancestors, thinking in terms of cause and consequence was paramount. The use of local sources and building in harmony with nature are often at the basis of ancient societies, from which we can learn a lot when it comes to sustainability and closed, self-sufficient systems, as can be found all over the world.[39] So when we look at cultural traditions, there is no place for uniformity and standard solutions, because landscape logic was the guiding principle for their existence.

Landscape logic as a guiding principle

Based on their landscape logic, landscapes can be divided into different landscape types. A landscape type is a unit where the physical condition (relief, soil, and water), the history of land reclamation, and/or the characteristic spatial organisation of landscape elements is the same.[40] Such characteristics strongly contribute to the identity and attractiveness of the landscape. As a result, different landscape types can be distinguished, such as the river landscape, sand landscape, peat-bog landscape, clay landscape, etcetera. Jan Bijhouwer, Professor of Landscape Architecture in Wageningen and Delft (NL), was the first in the Netherlands to map and describe landscape types, using the drawings that are so characteristic of him.[41] For him, landscape types were a spatial expression of various ecological and social-cultural factors.

Traditional local architecture as an illustration of the use of local resources and creating buildings in concert with nature. Tianluo-keng tulou cluster, Fujian, China (Photo: Steffen Nijhuis, TU Delft)

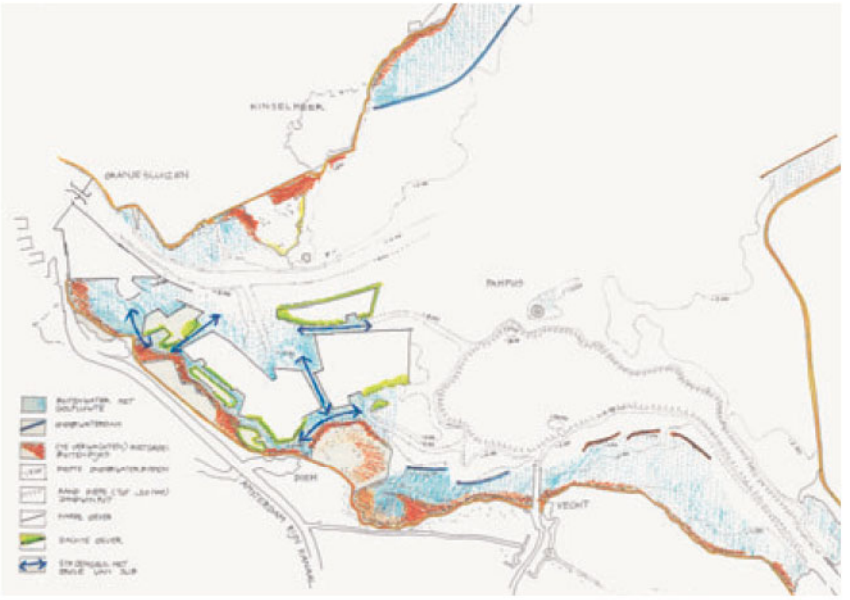
Frans Maas, Professor of Landscape Architecture at Delft University of Technology, further developed the research into the relationship between buildings and landscape. He made a map in which the interconnection between country estates and their landscape context became clear.[42] He also came up with a design approach in which buildings and building patterns respond to the character of the landscape.[43] One could say that he suggested a landscape-based approach to urban development.

However, he was not the first. As early as 1890, the American geologist John Wesley Powell suggested a spatial planning approach based on river basins in the west of America.[44] In 1913, the landscape architect Warren Manning was the first to use a layer-based approach in order to put the soil centre stage when it came to nature conservation and urban development.[45] Bijhouwer was involved in the design of large land reclamations such as the Wieringermeerpolder and the Noordoostpolder. In these projects, it was not just soil and water that played an important leading role in spatial planning, but the beauty of the landscape was also an important design factor for him, with space, size and scale as design principles.[46]

More recently, Professor Clemens Steenbergen and Wouter Reh in Delft developed a landscape-architectural perspective on the formation of metropolises, focusing on the architecture of urban parks and landscapes. The research elaborated on landscape-architectural form concepts for the development of urban landscapes. This culminated in a standard work entitled *Metropolitan Landscape Architecture*, with examples mainly from Europe and North America.[47]

Frits Palmboom and Dirk Sijmons, who later would both be affiliated with Delft University of Technology as professors, focused on the practical implementation of landscape-based urban development in the Netherlands. Sijmons emphasised the importance of the landscape frameworks as foundations for urban development, and suggested, together with Maurits de Hoog and San Verschuuren, a layer-based approach as a guiding principle for national spatial policy.[48] Palmboom developed a method of analysis for landscape-conscious urban design, in which

Taking the landscape as the basis for the design of IJburg, Amsterdam, the Netherlands (Source: Palmboom et al. 1996)



the drawing plays a central role. As designers, Palmboom and Sijmons also took the lead in urban planning developments such as IJburg in Amsterdam, in which landscape logic is central.[49]

It is impossible to describe these developments in full here, but it is high time for us at TU Delft and similar institutions to focus our attention on design-related research again, and develop applications in which the landscape as a natural and sociocultural construct takes centre stage again.

Internationally, there have also been serious attempts to increase the awareness of the value of nature and landscape in urban development from the twentieth century onwards. For instance, Ian McHarg was an American landscape architect who in 1969 became world-famous with his book *Design with Nature* and accompanying television appearances. In it, he argued that landscape architecture is excellently suited for integrating science, art and planning by means of suitability analysis with Geographic Information Systems (GIS),

which were invented by his fellow landscape architects Carl Steinitz and others. Nature and landscape were at the basis of the approach. Years earlier, this landscape-based approach had already been developed in his *Plan for the Valleys* (1962), Baltimore, where landscape logic was developed in regional designs with landscape-based design principles.

Other groundbreaking works are *The Granite Garden* (Spirn, 1984) and *City Form and Natural Process* (Hough, 1984). These publications also emphasise the importance of insight into the natural environment of cities – water, geology, plants, and animals – as a precondition for creating better, liveable urban environments. Many concepts and approaches to designing the relationship between humans and the

General planting scheme of the Noordoostpolder (1947). In this plan, it was not just soil and water that played an essential role in spatial planning but also the beauty of the landscape (Image: Nieuw Land)

natural environment have been developed on the basis of this understanding. Examples are *Biophilia* (Wilson, 1986), *EcoCities* (Register, 1987), *Eco Urbanism* (Ruano, 1999), *Green Urbanism* (Beatley, 2000), *Landscape Urbanism* (Waldheim, 2002) and *Ecological Urbanism* (Mostafavi & Doherty, 2010). The concepts and approaches that are described in these publications offer powerful points of departure for using nature and landscape as the main driving and shaping forces in urban development, but often lack perspectives on socio-cultural aspects of the landscape, or pay no attention to design-oriented research methods. Hence the need for an approach in which landscape logic is used as the basis for urban development: *landscape-based urbanism*.

32 Von Humboldt & Bonpland 1807/2009.
33 Cf. Von Humboldt 1845-1862/2014.
34 Von Frijtag Drabbe 1954, p. 7.
35 Fisk 1944.
36 Piesik 2023.
37 Vitruvius c30-20BC/1999; Columella 4BC-65AD/1941.
38 Yu 2020.
39 Berkes 2018.
40 Visscher 1975, Berendsen 2000.
41 Bijhouwer 1944, further developed in 1971 and 1977.
42 Maas 1967.
43 Buro Maas 1979.
44 Stegner 1962.
45 Manning 1913.
46 Bijhouwer 1955, see also Hudig (1928) for an argument in favour of beauty in planning and designing the new polder landscape.
47 Steenbergen & Reh 2011.
48 Sijmons 1991; De Hoog, Sijmons & Verschuuren 1998.
49 Palmboom et al. 1996.

4 Landscape-Based Urbanism

Kerckebosch, Zeist (NL), is an example of a landscape-conscious urban development in which the landscape context determined the opportunities and limitations for the spatial programme and its organisation and design (Photo: wUrck architectuur, stedenbouw en landschap)

Landscape-based urbanism is an approach in which the landscape is the basis for designing sustainable urban environments.[50] The core of the approach consists of designing with nature, people and history. It is a specialisation within landscape architecture that focuses on understanding, conceptualising and designing urban environments in harmony with nature and the landscape. It aims to acquire knowledge of landscape logic as a basis for spatial planning and design. In this context, knowledge production is context-driven, solution-oriented and inter- and transdisciplinary, so in partnership with other disciplines and stakeholders.[51] Also, spatial design is used across scales as a means to explore and visualise an imaginable and desirable future. Designing to build a better future, not just for humans, but also for other species with which we share this planet.[52] Academic precision is used to inform, test and verify the designed result. As designer and educator Papanek put it: *'These dangerous times for Earth call not just for passion, imagination, intelligence and hard work, but – more profoundly – a sense of optimism that is willing to act without a full understanding, but with the faith in the effect of small individual actions on the global picture.'*[53] Even small contributions make a difference.

Landscape as a design approach

In landscape-based urbanism, designing is not about a form of blueprint planning in which everything is thought out beforehand, without attention for unexpected changes that require adjustments. It is about cultivating a design approach that promotes thinking in terms of landscape systems, and puts designing with nature and people centre stage. This requires a process that is not limited to the domain of landscape architects and urban planners, but in which other fields of knowledge are actively involved, such as hydrologists, biologists, sociologists, etcetera. It is also about the people living in an area, businesses, politicians and other stakeholders. Reflecting and generating knowledge and ideas together is central. And later, of course, implementing sustainable solutions at different levels of scale.

Design is also used as a research strategy, which is often referred to as *research through design*. Research through design is about systematically exploring and visualising necessary, possible and/or desirable changes in landscapes.[54] This process forms the basis for generating and evaluating (alternative) ideas and concepts. Pen and paper play a

Intuitive interfaces can ensure a rapid interaction between interventions and insight into their effects, and thereby become a component of the design process (Image: Eckart Lange, The University of Sheffield)

crucial role as a tool for thinking, to spatially translate knowledge and ideas, combined with imagination, creativity and innovation. By drawing or mapping, one can increase one's understanding and explore possibilities. During this process, a conscious or unconscious synthesis takes place that crystallises in a visual form in a particular way, in analogue or digital media.

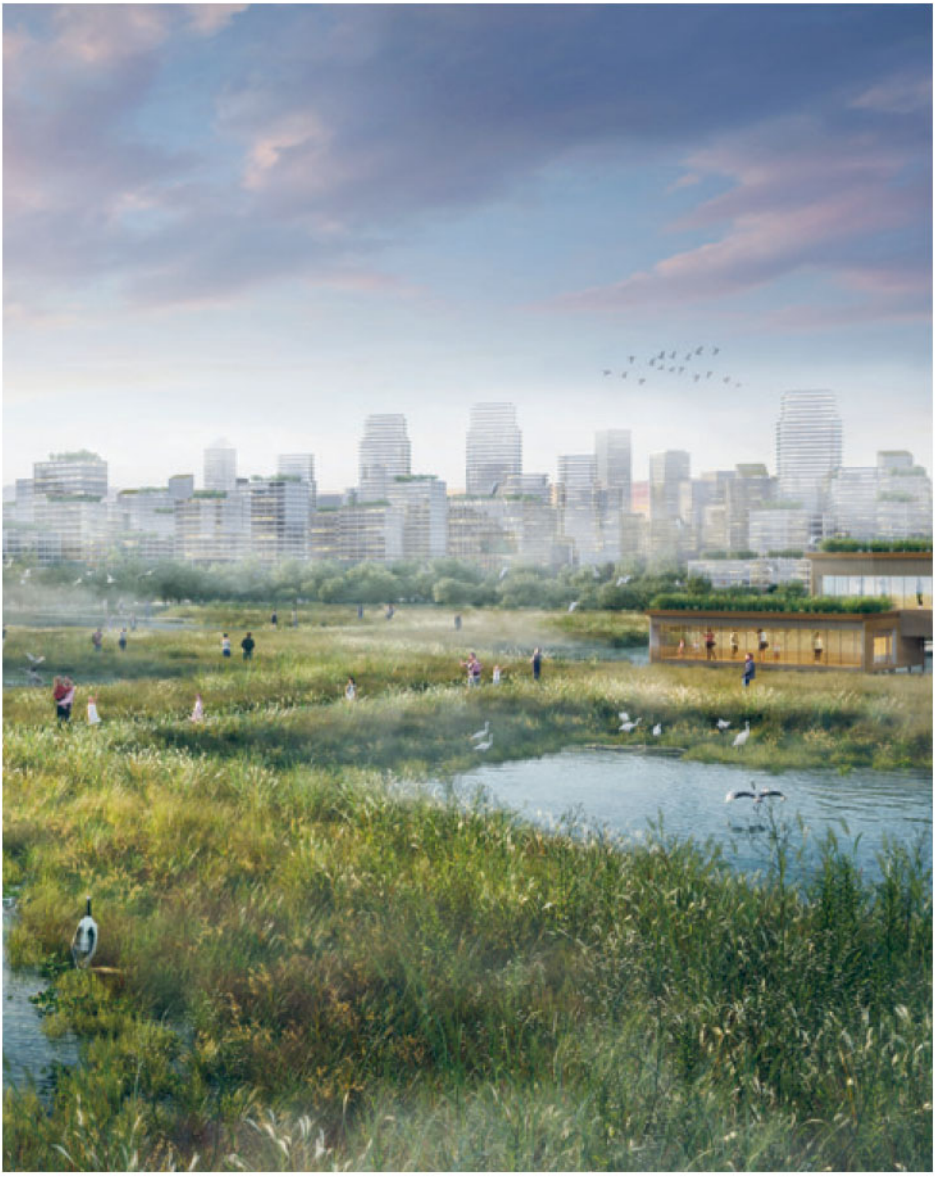
We can use digital technology, such as Geographic Information Systems, Virtual Reality, Augmented Reality, Tangible User Interfaces and Artificial Intelligence, to research reality, to simulate, complement, or conduct design experiments. Therefore, we can use this and other technology to support thought processes for analysis and design with calculation power and imagination.[55] Intuitive interfaces can ensure a rapid interaction between interventions and insight into their effects, and thereby become a component of the design process.

Designing with nature

There are four perspectives on using design in landscape-based urbanism. In the first place, there is the focus on designing with nature. Here we utilise the processes and functioning of nature. Working with processes of sedimentation and erosion by wind and water are also part of this. The Marker Wadden, new islands in the Markermeer (NL) designed by Vista landscape architects, provide a fine example of how, by creating the right conditions, one can bring back nature and at the same time realise a new, self-sufficient settlement.[56] By designing the landscape in detail, large-scale natural processes are controlled. Swamps, shallow water and self-sufficiency show how nature and humans can coexist harmoniously.

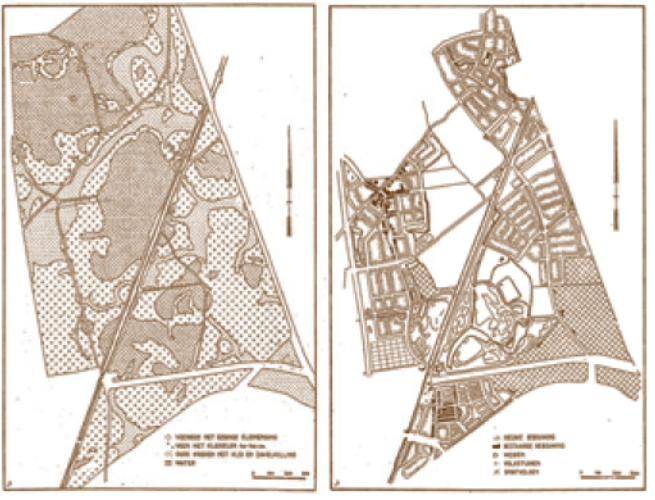
When we put nature centre stage again, abiotic factors such as climate, altitude, soil and water determine the possibilities for urban development. This is nicely illustrated by the plan that Bijhouwer suggested for the garden village Kethel in Schiedam (NL) in 1947, in partnership with urban planner Siebers (municipality of Schiedam).[57] According to Bijhouwer, the condition of the soil had to be the guiding

pp. 42–43
Using design to build a better future not only for human beings, but also for the other species with whom we share this planet (Image: Steffen Nijhuis with OKRA Landscape Architects)



principle for determining land use, the course of roads, and the positioning of buildings. At Bijhouwer's request, soil science professor Edelman therefore created a soil map that served as a basis for the structure of the new neighbourhood. Thus, the peat areas were used mainly for parks and water, and buildings were situated on the clayey, more stable subsoil. With his academic background as a biologist-geologist, Bijhouwer was able to examine the required fields of knowledge and collect information himself.

In designing for nature, we use restoration, management and rehabilitation of ecosystems as formative forces. It is not just about making larger interconnected nature areas and networks, but also about making gradients, as identified by Chris van Leeuwen, an ecologist who would later become a professor in Delft.[58] No hard borders but soft borders (*limes divergens*, as he nicely put it); gradual and dynamic environmental transitions between wet and dry, high and low, from nutrient-rich to nutrient-poor. Often, this is about creating natural gradients or ecotones.[59] This refers to the transition zone between two biotopes where ecosystems meet and mix, like the edges of forests or tidal zones.



Soil as the guiding principle for determining land use and the positioning of buildings in the design for garden village Kethel in Schiedam (NL). On the left, the soil map that served as the basis for the design (right) (Source: Bijhouwer 1947)

Building blocks for designing with ecological succession
(Image: Sjef Jansen, Vista, Planecologie, TU Delft)

It is a dynamic zone that is constantly in flux. These zones contain an exceptional biodiversity and richness of species. They create interaction and diversity, and increase the adaptive ability because nature is able to adjust.

Spontaneous development and change in vegetation is an ecological process that we can also use as a design tool. This ecological succession is the process through which organisms colonise an area, adapt the area, and are expelled by new species over time. One can manipulate this natural development through management. Take for instance what happens when a piece of grassland is no longer intensively grazed or mown, as can be seen clearly in the Oostvaardersplassen (NL). In its structure and composition, diversity and dynamism emerge, multiple species can thrive alongside each other, and a robust ecosystem is created.

Designing for people

A second perspective is designing for people. This is about creating housing areas and cities that contribute to a liveable and healthy living environment at the scale of the neighbourhood and the district, but for the benefit of the city

and the region. Designing urban green space is also a crucial component of landscape-based urbanism. It is about planning and designing parks, nature, water and public spaces in the urban environment, but also about turning them into coherent networks that organise the city and connect it to the surrounding area.

Urban green space is defined as: "Large and small (sometimes very small) areas of urban open space, normally with vegetation, which are not built up or constructed over, which can be privately or publicly owned, and which have different and changing purposes and perceptions over time."[60] Therefore, urban green space can come in many different forms: small and large parks, planting of street trees, from peri-urban forests to small forests, from green roofs to community gardens, from planned areas to informal and spontaneous areas. But also, private estates, private gardens, industrial estates, university campuses and schoolyards, abandoned areas and nature areas in and around cities.[61] Urban green space plays an important role for nature, beauty, recreation, reduction of heat stress, rainwater buffering and storage. Studies have also shown that there is a connection between the canopy cover of trees in the city and cooling, better microclimate, and reduction of air pollution and noise.[62]

Urban green structures have to be easy to access and experience for everyone and have a human scale, not too big, not too small. By creating more shady public spaces, people are encouraged to spend more time outdoors and have more interaction with the people in their neighbourhood. They are meeting places, social infrastructures that are so important for forming social connections, thereby contributing to strong communities.[63] The World Health Organization recommends a maximum distance of 300 metres to the nearest green space (of at least 0.5-1 hectare).[64] This encourages the recreational use of green space, with positive consequences for both physical and mental health. Clear and simple design guidelines for the design of urban green spaces, such as Cecil Konijnendijk's '3-30-300 rule' (3 trees within sight of every house, school and workspace, at least 30% tree canopy cover, at most 300 metres to the nearest public space), help to spatially translate scientific insights.[65]

Urban parks

Parks are an important element in urban green space. The word park is derived from the Germanic *parrock*, meaning enclosed meadow. Later, this became *parcus* in Latin and referred to a large plot of enclosed woodland and grassland that was used for hunting and recreation. Because this landscape was grazed, it consisted of groups of trees in vast grasslands with ponds, bordered by woodland. In the eighteenth century, this landscape image was taken as a point of departure and perfected in landscape gardens designed for the country houses of the English aristocracy. Later, this model was also applied in urban settings.

From the second half of the nineteenth century onwards, urban parks were designed and opened up for citizens, with the aim of improving public health and the quality of the living environment. Birkenhead Park in Merseyside (UK), designed by Joseph Paxton and opened in 1847, is therefore one of the oldest public parks that was constructed with state funding. This park was the model for many of the urban parks that were later designed for the general public, with well-known examples such as Central Park in New York (USA) and the Vondelpark in Amsterdam (NL). Nowadays, every city has one or more such parks.

The Vondelpark in Amsterdam (NL) as a social infrastructure
(Photo: Daryl Mulvihill/ Alamy Stock Photo)

Reconstructed historical water-meadow near Haaksbergen (NL) to recharge the ground water (Photo: Jan Dolfing)

These and other guidelines may help to design urban green spaces, but also to improve and expand them, and thus to promote the health, wellbeing, and resilience of communities. When designing urban green space, it is important to take a context-conscious approach, as the possibilities and needs in, for example, areas with a lower urban density should be different from areas with a high density.

Designing with history

The third perspective is designing with history. This is about researching the history of the landscape and working with it. The landscape is a palimpsest, like a reused piece of parchment in which some of the scraped-off old text is still visible. Therefore, the landscape is a layered composition in which history is legible. Sometimes, this has so much value that we have to protect it. Sometimes, it is about adding a new layer to make people aware of certain events.

By studying history, we can also learn lessons that are useful for landscape-conscious urban development. Centuries-old urban cultures such as the Harappan civilisation of the Indus Valley (from around 2600 BC), for instance, show us how one can use landscape-based approaches for resilient

urban systems and adaptive urban development.[66] In comparison with the ancient Mesopotamian and Chinese cities, the cities of the Harappan civilisation were way ahead of their time in terms of urban planning and hydraulic engineering. They would remain unequalled until the Romans. Larger cities had centralised sewer systems and were built on raised brick terraces, above the flood level of the Indus. The cities were designed in such a way that they could respond flexibly to the climate, which was becoming warmer and drier. People invented new ways of retaining and storing water, but also by crop diversification in agriculture.[67]

History also teaches us how garden and park structures can be used to organise cities and regulate the climate, like we see in ancient Rome.[68] We also can often use historical landscape structures to solve contemporary problems. For example, in the zone of country estates around the Baakse Beek in Gelderland (NL), old watercourses were restored to retain more water in the area in order to prevent drought, for ecological recovery, and to make historical patterns visible again at the same time.[69]

Without romanticising the past, it is clear that local or indigenous knowledge often represents an accumulation of centuries of wisdom and experience when it comes to nature conservation, agriculture, and water management.[70] That we can still use this, for instance to prevent drought, is shown by the reconstructed historical water-meadow system at Het Lankheet near Haaksbergen (NL), where plots of land can be irrigated with water from streams in winter, in order to fertilise the land and replenish the groundwater. Or what we can learn about circularity from the mulberry-dyke-fish pond system in southern China, one of the most circular agricultural systems in the world, where silk, fish and food production form a closed chain. This and many other examples show how traditional ecological knowledge can be used for realising self-sufficient communities, and how we can deal with local resources in a sustainable way.

Architecture of space

The fourth perspective is about the architecture of space, the landscape as a three-dimensional construct, or rather four-dimensional, because seeing and moving are inherently interconnected. The desire for beauty and orientation in space and time are important motivations for design. How do we see and experience the space of a landscape at eye level, how do we move through it, what is the scale and size of the space? These are questions that are translated into design principles. Spatial-visual characteristics, such as unity, variation, contrast, rhythm, are used in the design to create attractive, recognisable and varied landscapes.

In the architecture of space, the emphasis therefore lies on research and designing the landscape 'from the inside out', as it is experienced by a person who is moving through the space.[71] An in-depth investigation is conducted into the visual manifestation of open spaces, surfaces, screens and volumes, and their connections in terms of structural organisation – balance, tension, rhythm, proportion, scale – and principles of organisation – axis, symmetry, hierarchy, date and transformation.[72] The point of departure is that the shape of the space, the plasticity – shape of space-defining elements – and the appearance – colour, texture and lighting – of spatial elements in the landscape determine the relationship between design and perception. Spatial design is about the shape and functioning of the three-dimensional landscape space, creating spatial dynamism. This can be the construction of a pictural landscape composition, the framing of a landscape or urban panorama, or the creation of optical illusions.

The architecture of space is not just about designing static images, but rather about designing a kinaesthetic experience. The images are not a goal in themselves, but are part of a series of three-dimensional images that together form the architectonic or mental image of the space of the landscape or city.[73] Since there is a causal relationship between seeing and moving, the role of movement is of great importance.[74] As Gibson explained: *'Locomotion is guided by visual perception. Not only does it depend on*

perception but perception depends on locomotion inasmuch as a moving point of observation is necessary for any adequate acquaintance with the environment. So, we must perceive in order to move, but we must also move in order to perceive.'[75] Routes and the corresponding spatial sequences are therefore important operative structures in landscape architecture, because they play a crucial role in mediating or facilitating the use and reception of (designed) landscapes. In 1934, the psychologist Kurt Lewin suggested the term 'Hodological Space' to describe these actual circumstances with which a person in motion is confronted.[76] The psychogeographical maps by Guy Debord in the 1950s and Hans Dieter Schaal in the 1970s are inspiring attempts to visualise perceptual space. From this perspective, the shape of a walk also becomes a relevant area of study in landscape architecture. Not only in the sense that it focuses on the phenomenological dimensions of the landscape, as suggested by the sociologist Lucius Burckhardt with his Science of Strolling (called 'Strollology' or 'Promenadology'), but also that it offers an alternative approach to landscape design, with spatial perception as its starting point.

50 Nijhuis 2022.
51 Nowotny, Scott & Gibbons 2001.
52 Rawston & Antonelli 2022.
53 Papanek 1995, p. 10.
54 Nijhuis & De Vries 2019.
55 Nijhuis 2013.
56 De Visser et al. 2023.
57 Bijhouwer 1947.
58 Van Leeuwen 1965.
59 Greek: *oikos*, 'household' and *tonos*, 'tension'.
60 Clark 2016, p. 2.
61 Clark 2016; Cvejić et al. 2015.
62 For an overview see: Konijnendijk 2023, 2024.
63 Klinenberg 2018.
64 World Health Organization 2017.
65 Konijnendijk 2023.
66 Keynoyer 1998.
67 Gosian et al. 2012.
68 Taylor, Rinne & Kostof 2016, pp. 103-113.
69 Nijhuis, Storms-Smeets & Thissen 2023.
70 Berkes 2018.
71 Nijhuis et al. 2011.
72 E.g., Bell 1993.
73 In this respect, routes play a crucial role in de structural organisation of the architectonic image (Frankl, 1914/1968; Lynch, 1960; Appleyard, 1970).
74 Straus, 1956/1963; Berthoz, 2000.
75 Gibson, 1986, p. 223.
76 Lewin 1934. '*Hodos*', a Greek word meaning 'road'.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5 Based on Landscape

Regional plan for landscape embellishment around Potsdam (Germany) by Peter Joseph Lenné in 1833 (Image: Stiftung Preußische Schlösser und Gärten Berlin-Brandenburg, Planslg. 3639. Photo: Daniel Lindner, 2000)

In order to further elaborate the four design perspectives of landscape-based urbanism, it is necessary to develop and apply practice-oriented methods for research and design. For this, particular areas of focus for further development are: [1] understanding landscape logic, [2] landscape-based regional design, [3] research into landscape-based models for urban regions, and [4] robust nature and landscape networks, [5] developing landscape-conscious urban development strategies, and [6] investing in future generations of designers and researchers.

Understanding landscape logic

As a first area of focus, landscape-based urbanism focuses on further developing methods for understanding landscape logic. This can be done by dividing the landscape into layers on the basis of dynamism, and thereby discovering what relationships there are between natural and cultural systems: how soil and water influence nature and the city. Other layer-based approaches focus on the relationships between physical structures (hardware), humans and society (software), and how this is organised (orgware).[77] Although cities can be seen as independent ecosystems, they are not

disconnected from the landscape context. They are even part of the landscape, because they have emerged from it and are intertwined with it. To study this in greater depth, methods are also needed to analyse landscape relationships and dependencies at different levels of scale. In landscape-based urbanism, we are therefore developing an approach that is based on the work of landscape ecologists such as Van Wirdum and others, who studied positional, conditional and operational factors and their interactions, and uses them as a point of departure for analysis and design.[78]

Position in the landscape

Position refers to the regional scale and is about the location of the city in the natural system. For instance, when we look at the basin of a river, it consists of an upstream, midstream and downstream part. These areas have their own characteristics in terms of soil conditions, hydrology, vegetation and landscape types. The position in the system determines the opportunities and impossibilities for urban development and biodiversity. After all, a city in the delta, or along a river, has different opportunities than cities built on sand or in the mountains. Systemic relationships of cause and effect also become clear; for example, when we retain more water upstream by developing layered natural forests, constructing swamps, and replenishing groundwater, erosion is prevented and there is less flooding downstream.

Landscape conditions

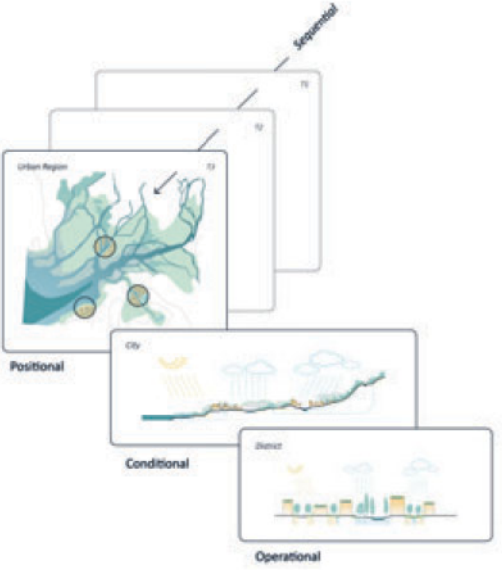
Landscape logic also provides insight into the conditions for spatial planning and design. Differences in altitude in the landscape determine the natural direction in which water flows, and by taking into account where water infiltrates, is retained, or gathers, a safe and sustainable water system is created. In a plan for the valley of the river Hunze (NL) by B+B landscape architects, the basin of the Hunze becomes a 'sponge landscape' that makes optimal use of the supply of percolating water from the higher Drents Plateau. In the wet winter months, the landscape recharges itself like a battery. In this way, there is enough drinking water in the dry summer months, and the development of peat nature is promoted.

Use of landscape

On the local level, the landscape logic is developed in designs and interventions that build on natural ecosystems that are present in the area, or even by developing new ones. In a design for the Grotestraat in Nijverdal (NL) by Okra landscape architects, a thoroughfare was transformed into a new green-blue structure, with climate-adaptive wadis where rainwater is collected and infiltrates into the soil in the valley of the stream. At the same time, the structure of the landscape has been made recognisable again by choosing plants that have a relationship with the surrounding nature areas.

Landscape-based regional design

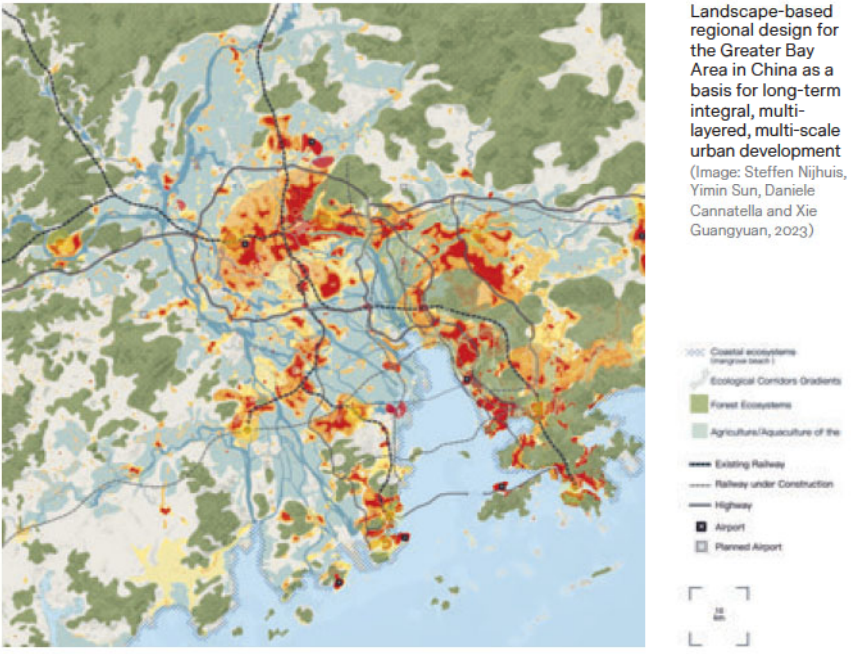
We can use this knowledge of landscape systems for regional design, another area of focus for landscape-based urbanism. To allow humans and nature to thrive, a regional perspective is needed to steer urban development in the right direction and to work with landscape systems. By focusing attention on



Analysing landscape relationships and dependencies at different levels of scale through time
(Image: Steffen Nijhuis, TU Delft)

the region (usually with a radius of 70-100 kilometres) rather than just the city, nature areas, water supplies, food supply, air quality and other natural resources can be protected and developed.[79] The basic principle is: thinking globally, planning regionally, and then acting locally.

Landscape-based urbanism is a regional design strategy that designs urban regions on the basis of landscape context. It takes the processes and functioning of nature as the basis for planning and design. Abiotic factors such as climate, altitude, soil, and water determine the opportunities for urban development, and the restoration, conservation, and rehabilitation of ecosystems are used as formative forces. The regional design determines the most suitable location,



Landscape-based regional design for the Greater Bay Area in China as a basis for long-term integral, multi-layered, multi-scale urban development (Image: Steffen Nijhuis, Yimin Sun, Daniele Cannatella and Xie Guangyuan, 2023)

function, scale, and mutual relationships for the sustainable development of a region (strategy) and provides a framework for local projects (intervention). The regional design is a long-term strategy, aimed at protecting, creating and regenerating coherent and living landscape systems in which (bio)diversity, cultural history and multifunctionality prevail. In fact, it is like gardening on a regional scale: cultivating a region in such a way that nature flourishes and people can live safely and healthily in an attractive environment.

Regional design should not only be translated into visions and designs on a regional level, but also into strategic projects that show how a long-term vision can be translated into short-term projects on a local scale. Such projects can be seen as pilot projects where one can learn what problems one encounters with regard to policy or funding during implementation, what works and what does not. One can also see how design principles for water safety, biodiversity, socially inclusive and healthy public spaces, and cultural history can be translated into spatial compositions. It is about integral, multilayered and multifunctional solutions. Thus, solutions for water safety, for example, can result in attractive landscape structures for humans and nature. By using landscape logic, we can build in a nature-inclusive and climate-adaptive way and ensure a healthy and safe living environment for everybody.

Landscape models for urban regions

A third area of focus for landscape-based urbanism is studying and finding landscape models for urban development. After extensive research into the development of urban regions around the world, Harvard professor Richard Forman distinguished four models of urbanisation: the Concentric-Rings Model, the Satellite-Cities Model, the Transportation-Corridors Model and the Dispersed-Sites Model.[80] He came to the conclusion that the last two models have the greatest negative impact on biodiversity and human resources due to fragmentation and the shrinking of habitats.[81] Concentric regional development patterns around urban centres, and satellite cities in combination

Design vision for a new urban district in Shantou for the local government, co-created in collaboration with national and international experts (Image: Steffen Nijhuis with OKRA Landscape Archi-tects)

with park systems and networks of large and small green structures in the city are most preferable when it comes to promoting the liveability and biodiversity in the urban environment. What role can landscape play in this? There are three ways: [1] landscape *determines* urban development; the structure and programme of urban development are dictated by landscape (e.g., soil and water are guiding); [2] landscape *influences* urban development; coherent natural and multifunctional landscape networks and (historical) landscape structures are included or designed as a mould for urbanisation, and are used to structure the urban region. (e.g., metropolitan landscape parks); [3] landscape as an *inspiration* for urban development: local references to the original landscape in the urban area, development of the fringes of cities, housing areas and green structures and elements (e.g., integration historical landscape structures and elements).

To further develop these ways, it is necessary to apply landscape-conscious design principles with regard to [1] conservation of natural habitats, species-focused

development and natural processes (area size, edges, corridors and networks) [2] cultural and landscape heritage, [3] climate adaptation (water safety, heat stress reduction, etc.) and [4] healthy and inclusive public space. In addition, it is also important to further develop concepts such as 'landscape-conscious development of urban fringes', which are concerned with developing landscape gradients and identifying funding models for this. Or the idea of '*sparing-sharing*', where, on the one hand, nature is protected by large nature areas and large parks, and is combined with compact urban development with a high density, or, on the other hand, developing a multi-functional green space with low-density buildings.

Robust nature and landscape networks

Here, landscape-based urbanism focuses on further exploring how metropolitan landscape architecture, and nature and landscape networks as design concepts, can contribute to regional coherence and can steer urbanisation in the right direction. It is actually about making robust and continuous nature networks and multifunctional landscape parks as a mould for the city, where ecosystems are protected and can develop themselves further. Complemented by recreational route networks that connect city and countryside through opportunities for walking and cycling, but also where cultural-historical elements, such as country houses and water management structures, as part of the cultural biography, make the region legible, and contribute to solutions for water problems and nature development in urban regions.

pp. 60–61
The Haverleij in 's-Hertogenbosch (NL) is an example of projecting a new landscape structure onto an old one in such a way that both remain recognisable, but new qualities are added at the same time (Photo: Drone Addicts)

The tradition of metropolitan landscape architecture, as can be seen in Peter Joseph Lenné's plans for *landschafts-verschönerung* around Potsdam (Germany) in 1833, or Charles Eliot's Boston Metropolitan Park (USA) from 1893, and more recently the Emscherpark (Germany) are examples from which we can learn a lot.[82] Steenbergen and Reh distinguish three organising principles in metropolitan landscape architecture: [1] the landscape theatre, in which visual networks and sight relationships are the point of departure for the design of the urban landscape, [2] the landscape of

flows, with infrastructure and movement as a point of departure for design, and [3] the plantation, in which the urban programme predominates.[83] These and other comparative studies deepen our knowledge by mapping the toolkit of landscape architecture. We can also deepen our knowledge by studying how regional green and park systems can contribute to the development of healthy ecological systems in urban regions, with natural gradients, and where biodiversity in all its forms is central again. In that case, the landscape is a foundation for the city and provides structure, ecological coherence and variation, but is also flexible and multifunctional.

Landscape-conscious urban development strategies

Another area of focus is the development of landscape-conscious urban development strategies. The city is inextricably connected to the landscape because of the subsoil, the water system, infrastructure, and also the history of its development. Landscape-conscious urban development is about using landscape logic for new plans. For instance, one can use this landscape logic by taking natural differences in altitude, such as moraines, *kreekruggen* (inverted creeks, now areas of higher land within polders), high riverbanks, dry valleys, and stream valleys, into account in spatial planning and design. These determine the natural direction of the water flow, and by taking into account where water infiltrates, is retained or collected, a safe and sustainable water system is created. When it comes to the choice of species for green urban space, it is advisable to use native species that are attuned to local natural conditions, in order to guarantee healthy plants and contribute to ecological coherence and biodiversity.[84] In that respect, the urban landscape also has its own logic in certain places. For example, extreme conditions due to the replacement of green spaces by buildings, combined with climate change, force us to use different species. Species that can deal with extremes, now and in the coming decades.

By studying realised projects, we identify at least nine tried and tested strategies for landscape-conscious urban design:
[1] *Prioritising:* the landscape context determines the opportunities and limitations for the spatial programme and its organisation and design;
[2] *Integrating:* landscape elements, structures and processes are absorbed into the new urban fabric and play a decisive role in design;
[3] *Restoring:* faithful reconstruction of historical landscape structures, elements or processes for nature restoration, re-creation, climate adaptation, or strengthening spatial identity;
[4] *Accentuating:* the (original) structure of the landscape is strengthened through design, in order to enhance the recognisability and orientation in time and space.
[5] *Imitating (or 'landscape mimicry'):* landscape elements or natural processes that are characteristic of an area are designed or used again in order to enhance the functionality, recognisability and biodiversity of an area;
[6] *Inspiring:* enhancing or determining the atmosphere or characteristics of a place by means of landscape design;
[7] *Transforming:* existing landscape structures and elements are gradually transformed into form or function;
[8] *Superposition:* new landscape structures are projected onto old ones in such a way that both remain recognisable, but new qualities are added at the same time;
[9] *Replacing:* landscape elements, structures and processes are completely replaced in order to create new social, ecological and spatial qualities.

Thus, the landscape provides motives for the design of the occupation structure based on the substratum, water system, plants, and history of occupation. The landscape structure of the new living area can be translated into the water system, green structure, spatial structure, and possibly a plan for raising the ground level.[85] The landscape then not only becomes visible via green-blue and recreational structures, but also in the type and arrangement of buildings and gardens, altitude, and the soil composition of the ground level. By using the landscape as the foundation for an urban plan, a richer and coherent picture emerges.

To practice 'landscape sport' is a great way to increase the awareness of nature and landscape among our children, the future city makers (Photo: Buiten Beeld/ Alamy Stock Photo)

Investing in future generations

If we want to steer urbanisation in the right direction, now and in the future, we have to invest in future generations by teaching them to love the landscape and giving them tools for landscape-conscious research and design. It starts by increasing the awareness of nature and landscape among children by taking them outside to see and experience biodiversity and human-made landscapes. But of course, also through education and attractive (picture) books. *Green. The Story of Plant Life on Our Planet* by Davies and Sutton is an example of a beautiful picture book that explains biodiversity and landscape systems to children in an accessible way.[86] The recent German-language Pixi book *Landschaftsarchitektin Lena plant einen Park für alle*, published by the German association of landscape architects (BDLA) is another example.[87] This book introduces children aged between four and seven to the job of a landscape architect, in a playful and simple way, using scenes from their daily life.

Education programmes at universities and universities for applied sciences should train landscape architects who are able to recognise landscape logic and use it for designing future-proof urban development all over the world.

Educational institutions should train professionals and scientists who are able to connect research and design, are able to cooperate with different disciplines and people, and are solution-focused. They also should be able to translate knowledge into spatial plans that are socially and ecologically inclusive and guarantee regional coherence, while at the same time providing a context for short-term projects on a local scale. Not that we can solve all global problems by doing so, but we can make a contribution to a better world by further cultivating the interaction between science, technology and design, and developing applications that make a difference.

There is also still much to do in terms of knowledge development. Although landscape architecture as a scientific discipline has developed an increasingly strong focus on research, when one compares this with the long and rich history of its professional practice, it is clear that it still has to strengthen its research culture.[88] To strengthen the importance of landscape architecture in academia and society, its academic basis can be further developed by means of landscape-based urbanism. The new generation of researchers and professionals have to take the lead in applications, knowledge gathering and dissemination, in order to create sustainable cities and communities in which the landscape is considered a foundation.

77 Nijhuis 2020; cf. Braudel 1966.
78 Van Wirdum 1979; Jalink & Jansen 1995.
79 Forman & Wu 2016.
80 Forman 2010.
81 Idem.
82 Eliot & Baxter 1893; Projekt Ruhr GmbH 2005.
83 Steenbergen & Reh 2011.
84 Maes 2013.
85 Reh 1980.
86 Davies & Sutton 2024.
87 Kupper & Kissling 2022.
88 Van den Brink & Bruns 2014.

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Colophon

Landscape Logic was published on the occasion of the appointment of Prof. Dr. Ing. Steffen Nijhuis as Full Professor of Landscape-based Urbanism at Delft University of Technology, Faculty of Architecture and the Built Environment (NL), on 28 March 2023. The text is an adaptation of his inaugural lecture, held on 2 February 2024 in the Aula of Delft University of Technology.

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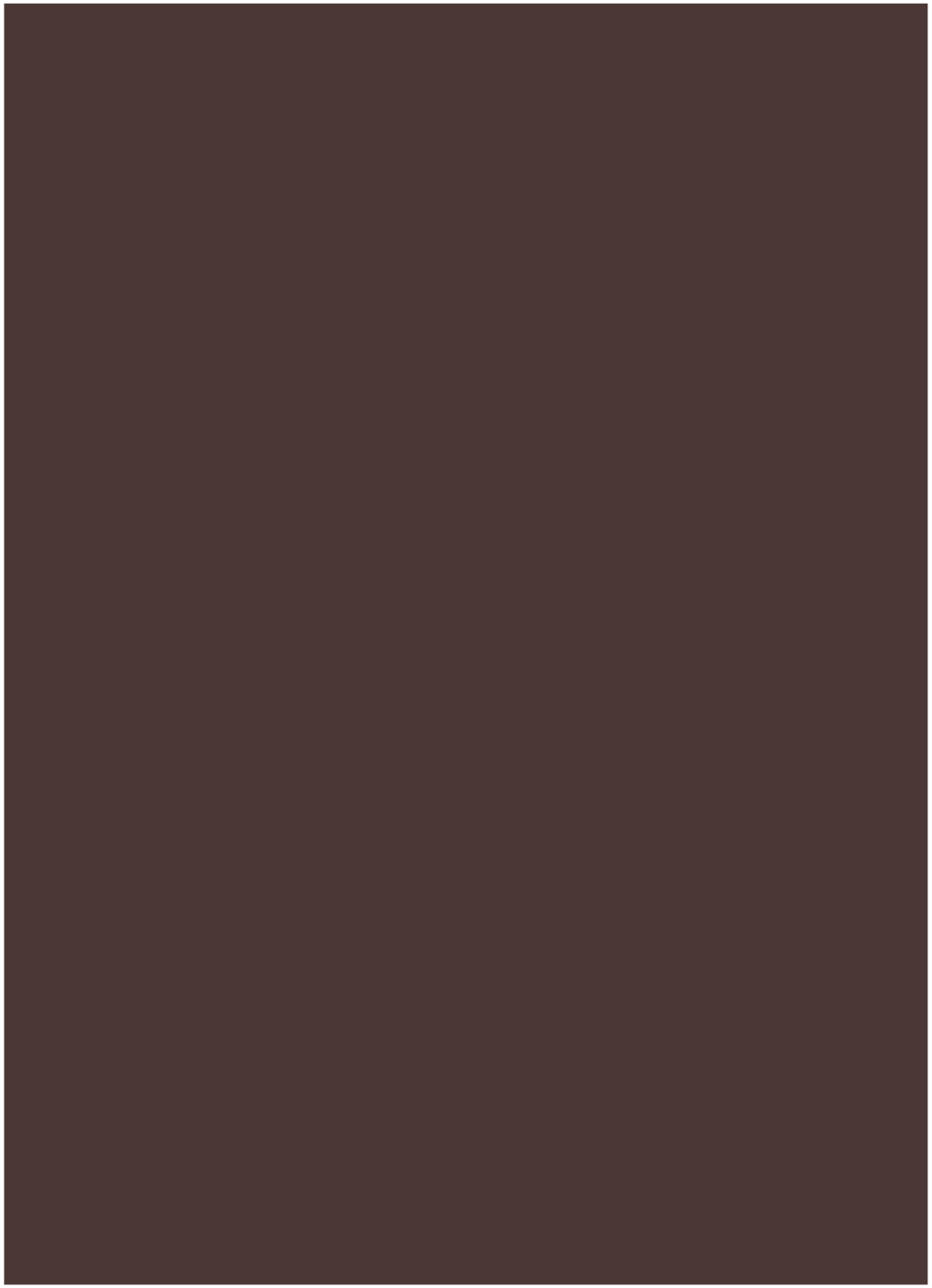

Landscape Logic is an essay on the need for a landscape-based approach to designing sustainable urban environments.

Urbanisation is one of the biggest challenges of this century. Urban development comes at the expense of fragile ecosystems that protect and provide us with food and water, not to mention the associated increasing vulnerability to flooding, drought, and social inequality. We therefore need a landscape-based approach to urbanism that considers the biosphere as the context for social and economic development and takes the landscape as its basis.

Landscape-based urbanism utilises the understanding of the landscape system and its ecological and social-cultural processes and relationships – *landscape logic* – as the foundation for designing sustainable urban environments across scales. Design with nature, people, and history are at the approach's core. Using landscape logic, we can build nature-inclusively and climate-adaptively and ensure a healthy and safe living environment for everyone.

Steffen Nijhuis is a Full Professor of Landscape-based Urbanism and head of the landscape architecture section at the Faculty of Architecture and The Built Environment, Delft University of Technology, the Netherlands.

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