JDU

Journal of Delta Urbanism
Delft University of Technology

Issue #01 PREMISES

Autumn | Winter 2020

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Delta Urbanism Premises

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The title of this journal is the offspring of Han Meyer who started the interdisciplinary research movement Delta Urbanism about 25 years ago. The two words describe the concept that brings focus on an integrative and interdisciplinary approach in the planning, designing and engineering of urbanised deltas –*fragile and highly dynamic landscapes at sea, in deltas, and in estuaries*– facing extreme challenges from competing claims and interests. As discourse, it investigates the possibilities to combine flood resilience, soil regeneration and water management strategies with urban design, landscape architecture and spatial planning. Finally, as practice, it has the objective to improve spatial form, function, and performance and innovate urban systems in urban and metropolitan delta and coastal regions.

The urgency for this novel approach is seen in the quest for a new dynamic equilibrium between urban growth, port-development, agriculture, environmental and ecological qualities, flood-defence systems and fresh-water supply. Delta Urbanism, as a field of interest and action, positions itself in this search of a *new modernity*: planning, designing and engineering the co-existence and equity between different forms of life and inhabitation and their reciprocity within the natural environment as a whole. →

The design of transformative *(revolutionary)* change started here by documenting and deconstructing this new modernity. This analysis led to a critical reflection on the rationality and form of the technological apparatus that we are currently relying on and its impact on the natural environment, on the urban question, and on the changing climate. What follows is the continuous search for new design cultures, as material and ecological practices, capable of concretely providing climate adaptation, environmental regeneration, socio-ecological resilience and equality across spatial and temporal scales.

If the set of social, political, economic and intellectual frameworks previously and currently in place led to the overexploitation and consumption of land and oceans then, for the future, new frameworks are needed[1]. Balancing competing claims in deltas and coastal areas requires new relationships to be forged between design, engineering, science and governance. In this context, the research's discourse has the objective to ensure that urbanised deltas and coastal areas are more liveable, more robust, more resilient and more adaptive. Therefore, to start a change of perception and movement towards the delineation of novel frameworks, two critical questions were set at the core of Delta Urbanism Research Group work at Delft University of Technology (TU Delft):

What are the urgent and the strategic research premises needed to revise the existing and envision new knowledge frameworks and practices?

How an interdisciplinary framework where governance, planning, design and engineering – working as a set of collaborative and evolving ideas and actions – could support a more radical approach of the adage 'design with nature'?

The discourse evolves around the following research sub-questions:

How can a dynamic equilibrium between urbanisation, environmental quality and safety be made in deltas and coastal areas?

How can fruitful interdisciplinary approaches of design, engineering, science and governance be produced and maintained?

How can we define a new balance between planned, designed and engineered interventions in the system of the deltas and coastal areas and, at the same time, a freedom for self-organisation of natural and societal processes?

In order to document the legacy of the discourse and reflect on the proposed research questions, in March 2020 as a 25th anniversary, the celebration of 'becoming of age' of Delta Urbanism held the conference "*Delta Design in Times of Climate Crisis*". The conference brought together international scholars and practitioners ranging from different disciplinary backgrounds. Using the term *crisis* was important to bring about the urgency of present challenges but also the interest in the opportunities embedded in future pathways. By acknowledging the state of crisis, we were ready to envision the scope of *delta design* as leverage for transformative change.

The present crisis is not only seen in the changing climate, loss of biodiversity and ecosystem degradation but it is also seen as a crisis of representation. The conference discussed on the larger value systems in society and their materialisation in space, and on the urgency to address the predominant segregation between knowledge frameworks. The segregation between engineering and spatial disciplines leaves us currently unequipped to deal with the changing socio-ecological systems. The conference concluded with the claim for a more contextual, culturally sensitive and therefore situated approach in planning, design and engineering, going back to the balance and search for reciprocities with the natural system. Such an approach in the Netherlands is called the *Fine Dutch Tradition*[2], the result of the

coherence between water management and urbanism – as territorial and socio-ecological project[3].

The present and future of the discourse thus focusses on interdisciplinary design, which is delta design, the delta of planning, design and engineering. At TU Delft, the research group Delta Urbanism represents the disciplines of planning and design at the Faculty of Architecture and the Built Environment. Having a close cooperation with water management, hydraulic engineering, transport, infrastructure and logistics, and geo engineering, at the faculties of Civil Engineering and Geosciences and Technology, Policy and Management, the engineering of the delta is completed, in research and education[4]. This cooperation is literally the root of the Department of Urbanism at the Faculty of Architecture and the Built Environment. This close relation was self-evident when the department started after the World War II, when its first students followed hydraulic engineering and land surveying courses at the sister Faculty of Civil Engineering and Geosciences.

RESEARCH PREMISES

In the past five years, the work produced within the framework of Delta Urbanism Research Group focused on the changing nature of the urban and territorial project in deltas and coastal areas. By positioning Delta Urbanism as an interdisciplinary field of interest and action, delivering a multiscalar and situated approach[5], the group has been supporting the development of the Delta Urbanism discourse further, envisioning and deriving a new set of spatial conditions, identities and values in delta, maritime and riverine landscapes. Ultimately, the aim is to tackle the fragility and resilience of territories at risk. To do so, recent projects have documented interdependencies, synchronicities, and/or conflicts between environmental, technical, political, economic, and societal processes — from large, regional scales to architectural and procedural scales and subjects. As an outcome of Delta Urbanism ‘coming of age’ reflections initiated by the conference in March 2020, four research premises currently cluster the group work. The four premises have as common line of interest

the agency of design and technology and the development of specific methods of analysis, design, visualisation and interdisciplinary work.

Land-Water-Atmosphere Continuum

Changes in any system, whether spatial, legal, economic, or environmental, manifest themselves in consequences that are often unpredictable for other systems. This ecology of interactions is even more complex in a highly dynamic space characterised by risk and emergence such as delta, maritime and riverine landscapes. As an overarching premise, the objective is to research the agency of design at the territorial level – balancing the form, ownership, and performance of land, water and atmospheric systems.

Drawing the Delta

The explosive character of urban development, especially in delta regions, often leads to chaotic and fragmented urban patterns, combined with increased risk of flooding, land depletion, erosion and ecosystem deterioration. The question is how a new (and necessary) organisation of the transitional space between land and water can contribute halting the erosion of the territory and reducing flood risk, while improving spatial coherence and ecological quality.

Reversed Engineering with Nature

On the scale of the urban district, the city is considered as a hybrid performative landscape which requires careful re-balancing and fostering new cooperation between the indigenous landscape and the techno-sphere of the urban systems. Synchronisation (in time, space, technology and interests) is at the core of this research premise.

Extremes

The deep uncertainty on the acceleration and aggravation of extreme scenarios of climate crisis introduces a new level of complexity. This calls for ingenuity and letting go of what is considered to be established. By exploring the missing

means of political, cultural, economic, spatial and technological representation, light is shed on viable futures in spaces at risk.

The aim is to highlight the urgency for change and put forward visualisations which can drive transitions towards a new territorial order.

EDUCATION. TOWARDS A MORE RADICAL APPROACH OF THE ADAGE 'DESIGN WITH NATURE'

The development of interdisciplinary approaches is at the core of the academic education delivered by group members under the framework of Delta Urbanism. Such approaches deal with the transposition and translation of concepts between knowledge frameworks and disciplines, and the use of design as an explorative method.

As a pedagogical project, our efforts lie in the integration of urban design theory and methods with knowledge from the disciplines of engineering, policy and management for the making of future pathways and transformative practices in territories at risk. This T-shape education philosophy is dedicated to the domains of the TU Delft Deltas, Infrastructures and Mobility (TU Delft DIMI) and gives direction to educational programs, improving the employability of graduates for the professional market of associated sectors. Delta Urbanism Research Group related education activities are situated in the broader context of the Delta Futures Lab, which is an interfaculty TU Delft lab where multidisciplinary groups of students cooperate with professional practice on infrastructure and environmental topics to research interdisciplinary design.

The *research-by-design* graduation studio 'Transitional Territories' at the faculty of Architecture is the leading educational activity where students develop novel frameworks, narratives and the use of design imagination for territories at risk all around the globe. Next to that, the honours program and the master course both named 'Infrastructure and Environment Design' are securing and enhancing these approaches.

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When overlooking the Delta Urbanism legacy and present efforts to develop this as a full-grown discourse the need for a platform was obvious: a dedicated space for the dissemination of ideas and construction, expansion and collection of an international body of knowledge. The platform as a place where to share academic innovation and critical theory, best practices and projects, and foster new dialogues and translations between fields of knowledge and their experts contributing to the Delta Urbanism discourse.

For this reason, this journal is started to build an integrative and interdisciplinary body of knowledge, connect and expand the international community around Delta Urbanism. There are other academic journals that express the merits of the Journal of Delta Urbanism premises, but most remain monodisciplinary or are interdisciplinary however not centred around the quest of a new design culture (a *new modernity*) as presented here.

With this understanding, TU Delft Delta Urbanism Research Group and TU Delft DIMI initiates this platform where knowledge and ideas are presented together, and a language is developed for the interdisciplinary community. The diversity in unity will also be expressed in the diversity of voices that the journal will accommodate. Besides the academic essays published in the section ‘Papers’, the journal introduces other four section types: ‘Practice’, taken into the policy and construction perspective; ‘Dialogue’ columns where different (complementary, agreeing and/or opposing) perspectives on a share topic are exchanged; ‘Project’ which is dedicated to frontier design research in competitions, prizes and research projects; and finally, ‘Dictionary’ building the Delta Urbanism language by slowly revealing, in every issue, the meaning of two terms important to interdisciplinary design.

This first issue is partly based on the conference Delta Urbanism in Times of Climate Crisis that was held at TU Delft on March 05 and 06, 2020.

The issue starts with the ‘Paper’ section, bringing as first essay the contribution of the opening speaker and founder of Delta Urbanism at TU Delft, Han Meyer, Emeritus Professor at the Department of Urbanism, TU Delft. He comprehensively and clearly explains the history of the concept Delta Urbanism. A close, familiar story, coming from his 25 years of dedicated work to this novel field of interest and action, summarising this involvement with research projects, education, and dialogues with experts in all levels that have contributed to the discourse. The second paper is from another keynote speaker of the conference, Richard Ashley, Emeritus Professor at the Department of Civil and Structural Engineering, University of Sheffield. Ashley argues on the fact that despite the present challenges and urgencies – the state of crisis – urban areas continue to follow the form set in the past by our industrial society, with little or no space for natural (blue-green) areas. He uses responses to the Covid-19 pandemic to reflect on the importance of those areas for quality of urban life and services and related changes in the way we live and value urban spaces.

The ‘Practice’ section brings the contribution of Daan Zandbelt, the Dutch Chief Government Advisor on the Built and Rural Environment. Based on his keynote speech at the Delta Urbanism Conference, he explores and explains the idea of Dutch designed ‘soft power’.

The ‘Dialogue’ column contains the contribution and exchange between Bas Jonkman, Professor of Hydraulic Engineering at TU Delft, and Henk Ovink, the Dutch Special Envoy for International Water Affairs. Critically reflecting on sustainable coastal adaptation and delta development in the Netherlands from respectively a civil engineering and a spatial planning and design and governance perspectives, they conclude that not only it is possible to develop a sustainable future for deltas, but that the integrated and inclusive approach involved will also create a pathway for reaching our global goals.

The ‘Project’ section is dedicated to introducing the explorative design work and research under development within the context of two Delta Urbanism research premises. They represent a fragment of ongoing theoretical and conceptual

design studies, casting light in (1) desirable/ possible synergies *by design* between atmospheric, soil and water systems and (2) the urgency of new methods and approaches towards the delivery of transformative change in face of extreme sea-level rise. The two contributions showcase recent projects lead by Taneha Kuzniecow Bacchin, Delta Urbanism, Assistant Professor Section of Urban Design at the Faculty of Architecture and the Built Environment (1) and Joep Storms, Associate Professor Section Applied Geology at the Faculty of Civil Engineering and Geosciences, TU Delft (2).

Finally, MaartenJan Hoekstra, architect, urbanist and historical linguist, Assistant Professor Section of Urban Design at the Faculty of Architecture and the Built Environment, sheds light on etymological origins, current meaning(s) and other interesting details of the *language* of Delta Urbanism. He takes off with the words ‘Delta’ and ‘Urbanism’.

We wish you an enjoyable and informative read and are eager to invite you for future contributions. Not only can you apply for all sections in this journal, but we are also open to well-considered experiments. Look forward to hearing from you!

Taneha, Fransje, Baukje, JDU Chief editors

REFERENCES

1 Yarina, L. (2019). Toward Climate Form. In: Davidson, C.; Iturbe, E. Eds. Overcoming Carbon Form. Log 47 Fall 2019. New York: Anyone Corporation.w pp. 85-92.

2 Hooimeijer, F.L. (2011). The tradition of making of polder cities. Delft: Delft University of Technology.

3 Meyer, H. (2017). The State of the Delta: Engineering, Urban Development and Nation Building in the Netherlands. Vantilt.

4 Hooimeijer FL, Bricker JD, Pel AJ, Brand AD, Ven FHM van de (2021). Interdisciplinary project-based education on urban infrastructure development: Lessons learned from a three-year international program. In review Journal for Urban Design and Planning (forthcoming).

5 Bacchin, T.K. (2015). Performative Nature. Delft: Delft University of Technology.

Papers

Delta Urbanism Coming of Age

25 years of Delta Urbanism where are we now?

Han Meyer

‘Delta Urbanism’ is a common field of interest of different disciplines, which discovered the need to work together in order to be able to develop fruitful strategies for the future development of urbanized delta regions. The birth of this collaboration can be dated in the 1980s and 1990s, with the rise of three different fields of concern on the effects of industrial society: the concern on the environmental impact of industrialization, the concern on the alarming state of affairs of cities in these years, and the rising concern on climate change. The development of a real program of Delta Urbanism at TU Delft started in 2005, with the International Architecture Biennale Rotterdam ‘the Flood’, the Katrina disaster in New Orleans and the start of the new Delta Program in the Netherlands as important driving forces. Important in the Delta Urbanism program is the search for a new ‘Darwinistic’ approach, emphasizing the evolutionary character of delta regions, and adaptivity as a main strategy to survive. This approach should substitute the traditional reductionist ‘Einstein’ approach, which is fitting in the dominating paradigm of the industrial society.

Delta Urbanism itself can also be considered an evolutionary field of interest: it is under construction continuously. For the future, we can appoint four important issues to be elaborated: a more radical approach of the new adage ‘working with water’, water as a leverage for a complex society in transition; making delta landscapes adaptive, and design as an explorative method.

INTRODUCTION. DELTA URBANISM PAST, PRESENT AND FUTURE

'Delta urbanism'- what's in a name? Celebrating 25 years of Delta Urbanism suggests that it all started somewhere in the early 1990s. Perhaps we can make that plausible with a little bit of fantasy. However, it is better to say that the first ten years functioned more as a period to explore the relation between urban patterns and water landscapes; a real start (and also the use of the term 'delta urbanism') can be dated around 2005, as I will argue in this chapter. This development shows that 'delta urbanism' is not a fixed method or discipline, but a field of interest and action which is learning continuously, and, by that, also changing time by time. The question is: what did we learn in the course of time, in what sense did we develop new knowledge, new methods of research and action, and where are we now? What can we say, after 25 years of trying, testing, exploring and redefining, about the next 25 years? What will and should be the mission of Delta Urbanism of the future? This chapter is an attempt to start with an answer on these questions.

DARWIN MEETS EINSTEIN

The term 'Delta Urbanism' has been used somewhere in the first years of the 21st century, to indicate a common field of interest and action of a number of disciplines. This common field of interest and action can be understood as a response to the industrial society of the 20th century.

The rise of an industrial economy in the 19th and 20th century was not only a revolutionary development in production methods, but influenced all fields of society and science profoundly. The basic idea, or the *paradigm* of the industrial society, which finds its fundaments in the Enlightenment, is the idea that everything in the world can be understood, explained, unraveled, reduced to its elementary parts, and finally rearranged, controlled and steered. This idea wasn't only applied in the industrial production itself, where raw materials were decomposed, transformed and combined, resulting in new products like refrigerators, vacuum cleaners or automobiles. The idea was also supposed to be applicable on the political organization of our society and on the spatial organization of our cities, industrial enclaves and agricultural production landscapes. Also science itself was organized according to this paradigm: divided in many different disciplines, with a clear playing field: each discipline with its own focus and methods and hardly communicating with other disciplines.

This became increasingly the *dominating* idea, but it was not the only idea about the world, economy, society and space. In his book *Darwin meets Einstein,* the Dutch physicist Frans Saris shows two opposite views on the world and science in the 19th and early 20th century, in which Einstein represents the reductionist paradigm of the industrial society, aiming to explore what nature is. On the other hand, Darwin represents a more evolutionary idea of the world, aiming to discover how nature works, in which direction it tends to change, and how species succeed to survive and to adapt to these changes[1]. *Survival* and *adaptation* are central key words in Darwin's theory.

For the time being, Einstein won the competition. This domination of the reductionist approach in science, as an essential part of the paradigm of the industrial society, has resulted in an unprecedented economic growth and to high levels of quality of life for millions of people. That is the

reason that it is very difficult to change this paradigm – even when it has become crystal clear this paradigm has brought, next to economic growth and welfare, also many problems like pollution, exhaustion of the earth, dismantling of urban communities and climate change. If we are talking about a *postindustrial* society, we don't mean a society without industry, but a society without the domination of the reductionist paradigm of the industrial society. In other words, instead of only focusing on Einstein, we need a little bit more Darwin.

2 Wolf, 2015
3 Meadows et al., 1972
4 Meyer, 2017
5 The Eo Wijers Foundation was established in praise of the late professor Regional Design and director of the *Rijksplanologische Dienst* (National Planning Service) Eo Wijers in 1985, in order to promote and stimulate design at the regional scale. https://eowijers.nl/

THREE FIELDS OF CONCERN: THE NATURAL ENVIRONMENT, THE URBAN QUESTION, CLIMATE CHANGE

Also delta urbanism itself can be interpreted as a 'postindustrial' response to the paradigm and consequences of the industrial society. More precisely, the rise of delta urbanism can be considered the result of three evolutionary processes, or three fields of increasing concern on the consequences of the industrial society. In the course of the early 21st century these three fields of concern were mixing up with each other. That process of mixing up can be regarded the start of what we call 'delta urbanism'.

The first field of concern was the natural environment. There has been a concern for the environment already since the nineteenth century, when people like Alexander Humboldt showed the systemic coherence of different natural environments and their ecosystems, and warned for the serious consequences of changing these environments by large scale hydraulic works[2]. Also the establishment of nature conservation organizations in the late nineteenth and early twentieth century, like the British *National Trust* and the Dutch *Natuurmonumenten*, was the result of an increasing concern for the rapid disappearance of nature areas because of the extension of industrial and urban areas and the construction of large scale infrastructural works.

But it was the report *The Limits to Growth* of the international counsel 'Club of Rome' in 1972, which rang the alarm on the disastrous state of affairs of the earth, caused by industrial production[3]. The report was not the only event which draw the broad public and political attention to environmental issues; better is to say that it was the most comprehensive and well-argued representation of a general *zeitgeist* of that period. From the mid-1960s, an increasing concern with the deplorable state of affairs of the natural environment was expressed by nature conservation organizations, biologists and ecologists in western countries. Ad-hoc citizen initiatives were established to protest against large scale industrial and infrastructural projects. *figure 01 — page 30* 

And with success: In the Netherlands, plans for nuclear plants and an airport south of Rotterdam were cancelled for this reason. Also the reclamation of the Markerwaard (the final part of the *Zuiderzee* works, north-east of Amsterdam) and the closure of the East Scheldt (the final part of the Delta works) were cancelled during the 1970s and early 1980s, as a result of strong protests[4]. In the central river area, citizen initiatives succeeded to obstruct the enhancement and elevation of the dikes, and to force the government to start a broad debate on the future of the river area, taking into account the cultural and ecological values of this landscape. It was the reason for the Eo Wijers Foundation[5] to start a design competition on the future of the Dutch river land-

figure 02 — page 30 

scape. The winning project, *Plan Ooievaar* ('Plan Stork',), was a plea for a radical change in river management, planning and design. Instead of continuing the approach of narrowing riverbeds and strengthening the dikes, they proposed to widen the riverbeds by the replacement of dikes and the construction of by-passes. The riverbed would get more room for extreme peak discharges as well as for more biodiversity. This groundbreaking change would become the major principle in the later program 'Room for the River'(2005-2015).

The *Plan Ooievaar* was submitted by a team of young landscape architects, ecologists and civil engineers, all recently graduated. It shows the rising interest in concern for the environment among the students of the academic institutions and young professionals.

The second field of concern was the increasingly dramatic and deplorable state of the cities in the 1970s and 1980s. The spatial policy of most western countries during the postwar decades was focused on the creation of a new type of urbanity, fitting in the idea of industrialization and modernization of the society as a whole. The emphasis was put on the layout of new housing districts in the urban outskirts and the countryside, on the industrial serial production of housing units in these new districts, on the promotion of the automobile as the representation of modern living in the industrial society par excellence, and, as an essential contribution of the public sector, on the construction of vast network of highways. The leading example was the New Deal policy in the USA of the 1930s and the many projects by 'power broker' Robert Moses[6]. It inspired postwar European policies, like the Dutch national spatial policy agenda in the 1950s and 1960s[7] and, especially, the policy and concepts for the reconstruction of the bombed city of Rotterdam. The result was a mass emigration of people from the existing cities to the new suburbs, leaving the old cities in an increasingly deplorable state. In the Netherlands, cities like Amsterdam, Rotterdam[8], The Hague, lost more than a quarter of their population in the period 1965 – 1980. The central city areas were left to chance, inhabited by

figure 03 — page 31 

a low-income population in an obsolete housing stock.

In other European cities comparable developments took place. With the departure of so many inhabitants, the cities lost tax revenues and the basic support for public as well as commercial facilities like schools, hospitals, shops, theatres, cinemas. Everywhere in the western world, cities were getting tangled in a spiral of neglect, impoverishment, decay and criminality. In the USA, large cities like New York and Chicago found themselves at the edge of bankruptcy during de mid-1980s.

The concern on the state of affairs of the big cities was not a result of a sudden awareness, but showed its first signs already in the 1950s and 1960s. In the USA, the books by Lewis Mumford[9] and Jane Jacobs[10] functioned as important manifests against the domination of modernistic concepts for urban development. In Europe, the sociologist Manuel Castells published his influential pamphlet *La Question Urbaine*[11] in 1972, which opened the eyes of many professionals and academics concerning the need for another policy in the cities. The result was a wave of attention to renewal and repair of the older housing stocks in many European cities in the 1970s, followed by an increasing attention to restore and revitalize

6 Caro, 1974
7 Bosma, 1993; Van der Cammen & de Klerk 2012
8 Wagenaar, 1992
9 Mumford, 1961
10 Jacobs, 1961
11 Castells, 1972

the urban diversity and economy of cities in the 1980s and 1990s. In the professional and academic world, the critics on the modernistic concepts led to a renewed attention to the relation between urban form and urban vitality, expressed by many studies on urban morphology and typology by several European as well as North-American 'schools'[12]. Several publications from this period still play an influential role in the current debate on urban design, like the books by Philip Panerai and Jean Castex, Christopher Alexander, and others[13]. As we stated in our first publication and seminar on 'Dutch Urbanism Today' in 2003, the special contribution of Dutch urbanists to this international tendency was the attention to the relation between the landscape and urban form. Urban designers like Rein Geurtsen, Maurits de Hoog, Frits Palmboom, Jaap van den Bout and many others, all of them active in academia as well as in professional practice, showed the need of being aware of the close interaction between the marshy landscape of the Dutch delta, the hydraulic systems to make this landscape inhabitable, and the specific character of urban form of Dutch cities[14]. This attention of urban designers to the landscape condition created the condition for a close collaboration of urban designers and landscape architects, and, as we already saw in the example of the *Plan Ooievaar* project, hydraulic engineers.

It was this special focus and attention to the relation between urban form and landscape, and the close collaborations between urbanists, landscape architects and engineers, which created the fundaments for the new urban regeneration plans in the Netherlands like those for the derelict port districts in Amsterdam and Rotterdam *figure 04 — page 31*  , but also for many new extension areas of the 1990s (the 'VINEX' projects[15]), like the Ypenburg project near The Hague, Nesselande near Rotterdam, IJburg near Amsterdam and Leidsche Rijn near Utrecht. The two fields of concern (with the environment and with the state of the cities) met each other and were interwoven in an increasingly common practice. This interweaving of urban design and landscape architecture was also expressed in the rise of a new generation of design firms like Quadrat, BGSV, Palmbout, West 8: all of them include urban designers as well as landscape architects.

Also in academia the attention to the mutual influences of urban design, landscape architecture and engineering was increasing in this period of the 1990s and early 21st century. The analysis of the construction and transformation of port city landscapes was an example of this attention, expressed in my study *City and Port*[16]. The PhD thesis of Fransje Hooimeijer is another example. She analyzed this combination of disciplines, starting from the 15th and 16 centuries, as a basic condition for the growth and beauty of the Dutch polder cities[17].

The third field of concern was climate change. The concern with this serious consequence of the industrial society started some decades later than the first two: The Intergovernmental Panel on Climate Change (IPCC) was founded by the United Nations in 1988, and delivered its first report in 1990. Since then, every three to four years a new assessment report in climate change has been published by the IPCC, with increasingly alarming conclusions concerning flood risk in densely populated areas. The general public and political awareness of the seriousness of climate change followed some later. The movie *An Unconvenient Truth* by All Gore, released in 2006, was an important accelerator of a growing public and political involvement

12 Moudon, 1994.
13 Panerai et al., 1975; Alexander, 1977. See also our treatise on the renaissance of the attention to urban form in Meyer et al., 2020, p. 36-41
14 Meyer, 2003
15 'VINEX' is an abbreviation of *Vierde Nota Extra,* which was a special attachment of the *Vierde Nota Ruimtelijke Ordening* (Fourth Memorandum on Spatial Planning) of the Dutch government, published in 1990. With the Vinex-document, the national government indicated exactly the locations and the allowed numbers of new houses of new urban districts
16 Meyer, 1996/1999
17 Hooimeijer, 2014

in this matter and was followed by international conventions and agreements in Copenhagen (2009) and Paris (2015). It is true that the concern on climate change can be considered part of the concern on environment, as described before. But the awareness of the impact of the industrial society on the *change* of the climate resulted in a new agenda for action: first, it showed the necessity of *mitigation,* which means the introduction of processes which could stop the emissions of greenhouse gasses. Energy transition, leading to a zero-fossil energy production, is the most important aspect of this part of the agenda for action. Second, the awareness of climate change showed the necessity of *adaptation*. This means that we should take into account that the consequences of the current climate change, like sea level rise, more intense precipitation and increasing discharges by rivers, but also the rise of temperatures and the increase of periods of heat and drought, will persist for many decades – even when we succeed to mitigate successfully tomorrow.

The most important consequence for our field of work - our cities and landscapes - is that we learned that we shouldn't regard cities and urbanized landscapes as industrial machines, but as complex, evolutionary systems, and that the future of these systems is uncertain. Complexity, evolution, uncertainty, adaptation became the new key words for disciplines like urban design, landscape architecture, hydraulic engineering, but also for environmental sciences, informatics, governance-studies. This is where the 'Darwinistic' approach is starting: Being aware of the evolutionary, complex character and uncertainty of urban landscapes. Working together, these disciplines started to pay more attention to the mutual influences of landscape characteristics, built interventions, water systems, manmade hydraulic systems, environmental processes and social, cultural and political processes.

In the Netherlands, the awareness that climate change was happening started in 1993, some years after the publication of the first IPCC report. The reason was an extreme peak discharge in the rivers in that year, followed by a second in 1995, which resulted in the evacuation of more than

figure 05 — page 32


250,000 people from their homes in the central river area . These events in the central river area contributed to a general awareness that something was happening which was never foreseen: a structural increase of the rivers discharge volumes, far more than ever calculated in previous years. Instead of enhancing and heightening the river dikes one more time, the perspective of the *Plan Ooievaar* of broadening the river beds offered more perspectives for dealing with complexity and uncertainty and for a new policy of *adaptation*. It resulted finally in the already mentioned program

figure 06 — page 33


Room for the River (2005-2015), offering more space for river water, and more possibilities to pay attention to the different desires of local communities and environmental issues concerning spatial, cultural and ecological qualities of the river area[18].

THE RISE OF AN INTEGRATED APPROACH

However, it is not before the middle of the first decade of the 21st century that Delta Urbanism became more tangible and recognizable as a special program, with special reasons and characteristics:

Urgency

Especially the debate on the environmental impact of climate change, the consequences for sea level rise and increasing river discharges, and, as a result, the increasing flood risk for cities in deltas and coastal areas gained momentum in 2005. It was the year of the 2nd International Architecture Biennale Rotterdam, curated by landscape architect Adriaan Geuze, who titled this event 'The Flood'. Linked to this Biennale, the book 'Atlas of Dutch Water Cities'was published, showing the legacy and existing practice of the interweaving of hydraulic engineering and urbanism in Dutch urban design[19]. But the Biennale especially showed that only cultivating the close relationship between delta landscapes, urban patterns and engineering systems was not enough; it was time to come with new solutions and new approaches.

Less than three months after this event, the dramatic Katrina disaster in New Orleans showed the correctness of this call to new solutions. For the Dutch government, it was the decisive reason to establish a Delta committee, who advised to start a special Delta Program. The final report of the Delta committee was entitled '*working together with water'*, which was a reference to the need of new solutions and a new approach: instead of 'fighting against water', which was the adage of hydraulic engineering in the 20th century, the Delta Committee plead for an approach which should be based on the understanding and use of the natural dynamics of water systems[20]. It was the same way of thinking which was the fundament of the program 'Room for the River', also starting in 2005 and intending to turn the dominating idea on the relation between water system and urban/economic systems 180 degrees. The Delta Committee and the Room for the River program pointed out the long term, slow but fundamental changes of natural water systems, and the impossibility to control or hold back these changes. So, instead of 'water systems should follow the logics of urban/economic systems', the Delta Committee plead for more attention to the need of 'adapting urban/economic systems to the logics of water systems'.

Complexity

The way of thinking in the Room for the River program and the Delta Committee was indebted to the work of the American landscape architect Ian McHarg[21], who plead for more attention to slow, long-term but very powerful changes of natural systems, and whose ideas were imported and elaborated among landscape architects and academics the 1970s and 1980s. These ideas joined those of the French historian Fernand Braudel, who showed the complexity and mutual influences of natural and man-made systems, and emphasized the influence of the natural landscape as an important, very slowly changing power on the culture of people[22]. His ideas of the 'longue durée' of natural systems became popular with urbanists in the Netherlands in the 1980s. The influence of these ideas show the increasing search for a more 'darwinistic' approach in Dutch urbanism and landscape architecture. This development was accelerated by the organization of two conferences on the relevance of complexity theories for urbanism at TU Delft, in 2009 and 2013[23]. Complexity theories were rising in all scientific fields from the 1990s, showing an increasing displeasure and discomfort of scientists with the dominating reductionism in science, and a search for new concepts and approaches for the big challenges of the post-industrial world of the 21st century[24]. Also in urbanism complex-

19 Hooimeijer, Meyer & Nienhuis, 2005
20 Delta committee, 2008
21 McHarg, 1969
22 Braudel, 1966
23 Both conferences resulted in a book: Portugali et al., 2012; Portugali & Stolk, 2016.
24 See for instance Mitchel M., 2009; Mitchel S.D., 2009; Saris, 2010

ity theories were recognized as relevant for a new approach in design and planning, taking into account uncertainty and the need to include possibilities for adaptation in spatial designs. It influenced the research and educational programs in Delft and other universities fundamentally.

TU Delft stimulated interdisciplinary and applied research in platform like the Delft Research Center Water (2003 - 2009) and the Deltas, Infrastructures & Mobility Initiative (DIMI, from 2009). The work by these platforms enhanced the awareness of the need of interdisciplinary collaboration and resulted in many invitations for advisory boards, workshops and conferences on water-related urbanism all around the world, including an advisory paper to the UN Habitat III conference in 2016[25].

Internationalization

The period around 2005 showed also a 'momentum' of a number of initiatives to regard the worldwide relevance of new approaches to water-related spatial questions. Initiated by KU Leuven urban design professor Marcel Smets, the TU Delft, together with KU Leuven, IUAV Venice and UPC Barcelona started a new European Master program on Urbanism (EMU) in 2005[26]. The EMU program, organized as 'master-post-master', and intended for graduated students with already some professional experience in architecture, landscape architecture and urbanism, functioned as an accelerator of new design and planning concepts for urbanization in water dominated regions, like the Dutch delta, but also the Veneto and the Venice lagoon, the Flemish lowlands and the Catalonian coastline[27]. The semester 'Constructing the Sustainable Delta City' of the Delft EMU program, and the many graduation projects of EMU students, dedicated to this theme, functioned as an accelerator of knowledge and new design concepts for urbanized delta regions. *figure 07 — page 34* 

The already mentioned disaster of Katrina in New Orleans also happened in 2005, and was the reason of the start of *Dutch Dialogues*, a close collaboration of American and Dutch academics and professionals to develop a new plan for the reconstruction of the devastated areas in the metropolitan region of Greater New Orleans. The result was presented as the Greater New Orleans Urban Water Plan in 2013[28].

Delta Urbanism as a program

These processes of increasing urgency, increasing awareness of complexity, and increasing internationalization, led to the development of a *program* of Delta Urbanism, in which research, education and a focus on application in practice were combined.

In the field of educational programs, the EMU played an important role, as already mentioned, as well as a special interdisciplinary graduation studio *Delta Interventions,* which became a central place of collaboration of students ànd staff members in Architecture, Urbanism, Landscape Architecture, Civil Engineering and Technical Management[29]. The studio was focused mainly on the Dutch territory, but was dedicated several times also to other places like New York (2013-2014, after hurricane Sandy in 2012), Houston (2014-2015)[30] and San Francisco (2016-2017). In addition, individual students also focused and graduated on deltas, rivers and coasts like the Mississippi delta, the Mekong delta, the Danube, the Parana delta in Argentina, and others.

25 Meyer & Peters, 2016
26 http://www.emurbanism.eu/
27 Important 'engines' in the EMU program on water was the work of Vigano and Secchi (IUAV Venice) on the Veneto region, developed with EMU students, and the work of DeMeulder and Shannon of KU Leuven. See Vigano & Secchi, 2016; DeMeulder & Shannon, 2013
28 Waggonner+Ball Architects, 2013
29 The studio started in 2008 and was originally titled 'Climate Adaptation Lab', coordinated by Anne Loes Nillesen, see Nillesen et al., 2016. From 2016, the studio is led by Taneha Bacchin
30 Kothuis et al., 2015

Both the Delta Interventions studio and the EMU studios functioned as an engine for intensified collaboration of staff members of Urban Design and Landscape Architecture at TU Delft, resulting in combined projects for the EMU program and to a series of common publications[31].

A PhD program on Delta Urbanism started, with PhD students from all over the world and focusing on the deltas and water landscapes like the Rhine river in Germany[32], the Rhine-Meuse delta in the Netherlands[33], the Pearl River delta (PRC)[34], Kaohsiung (Taiwan)[35], the Parana delta (Argentina)[36], Porto Alegre (Brazil)[37].

Also the Dutch Delta program, started in 2009, functioned as an important accelerator of research and education in Delft, for instance with extensive research programs in which universities and other institutes collaborated with each other intensively. Examples are the programs on multifunctional flood defenses[38], on the future of the Southwest delta[39] and the future of the Dutch coastline[40]. The results of the Delta Interventions Studio and the EMU projects were helpful for the advisory role of some TU Delft staff members (Maurits de Hoog, Anne Loes Nillesen, Han Meyer) in the Delta program on the Rotterdam region. This program aimed to explore different options for flood risk reduction in this region. The student projects, focusing on design explorations to discover potential effects and possibilities of the different options, played an important role in the recommendations of the TU Delft advisors to the Delta program, and in the final decision making of the Delta program itself.  *figure 08 — page 34* Moreover, the results of the student projects played a role in several scientific publications.

An important contribution was the initiative of the EFL Foundation[41] to start the Van Eesteren chair at TU Delft, dedicated to the future of the IJsselmeer area. The work of this chair (2014 - 2018) showed how design explorations can result in an inspiring vision on the future of an urbanizing deltaic region[42].  *figure 09 — page 34*

THE FUTURE OF DELTA URBANISM

From the work of the last fifteen years, we can distillate some issues which need to be elaborated in the next years. The most important of them are:

Working with water: more radical

The new adage of the Delta Committee 'working with water' seems to be adopted in main stream practice, considering the quantity of urban and regional plans which pay attention to the presence of water. However, looking with a more close eye to these plans, 'water' is mainly an added element in many of these plans, and not a guiding principle. The change from 'water follows function' to 'function follows water' is not yet a generally accepted rule in design an planning. The Room for the River program produced several interesting examples of applying this rule, for instance in the *Waalsprong* ('Waal jump') project in Nijmegen. During the 1990s, the city of Nijmegen had prepared a new plan for urban extension at the North embankments of the Waal river. Under these conditions, the only way to enhance the flood defense system was to elevate the river dikes. After many design workshops with the Room for the River program team, the plan was turned in a radical way: the priority was changed to the widening of the river bed by creating a

31 See for instance the publications of Meyer and Nijhuis 2013 and 2014
32 Redeker, 2013
33 Bobbink, 2016; Van Veelen, 2016; Nillesen, 2019
34 Tai ,2018
35 Chung, 2104
36 Zagare, 2018
37 Bacchin, 2015
38 The STW-funded program MFFD (Multifunctional Flood Defenses) was a collaboration of three universities: University of Twente, TU Delft and Wageningen University. See: Kothuis & Kok, 2017
39 The NWO- funded program IPDD (Integral Planning and Design in the Delta) was a collaboration of TU Delft, Erasmus University, Wageningen University and several other research institutes and private firms. See: Meyer et al., 2015
40 The *Atelier Kustkwaliteit* (Studio Coastal Quality) was a collaboration of and financed by TU Delft, Delta program, provinces, municipalities and private firms. See: Brand et al., 2014
41 The EFL Foundation (van Eesteren, Fluck & van Lohuizen Foundation) aims to pay attention and to explore the current relevance of the legacy of Dutch urbanists Cornelis van Eesteren (1897 – 1988) and Theo van Lohuizen (1890 – 1956). See: https://efl-stichting.nl/
42 Palmboom, 2018

by-pass; the plan for the new urban area had to be changed and was subordinated to the primary goal of the river system. However, it turns out to be difficult to apply this principle always and everywhere. Especially in densely urbanized and industrialized port areas, the focus still is on the function of the enhancement of these regions as central pivots of the industrial system and on the adaptation of the water system to this function. As described elsewhere, the Mississippi river delta and the Rhine-Meuse delta are two examples of port regions where the river system needs a radical change, but where it is extremely difficult to apply these changes because of the interests of the port industries[43]. This touches also the next issue:

Water as a leverage

In most urbanized river- and delta-regions, 'water' is not the only issue to be solved. Governments and planning institutions are facing multiple problems and tasks to solve: next to rising sea levels and increasing peak discharges of rivers they have to deal with energy transition, which needs a fundamental reorganization of the industrial economy to a circular economy, ongoing urbanization and shortages on the housing market, enhancing biodiversity and diversification of agriculture, potential revolutions in transport systems, etcetera. All these different issues are related to each other and influence each other. It makes spatial planning and design in these regions extremely complex and can result easily in paralysis. There are many courageous attempts to develop 'integral' or 'comprehensive' planning approaches, which try to pay attention to all these different issues and to develop coherent future visions. But the problem is that all these different issues have different evolutionary time-paths. The fundamental notion of the water system as an element of the '*longue durée*', as explained by people like French historian Fernand Braudel[44] and North-American landscape architect Ian McHarg[45], emphasized the need to give priority to the building of strong basic water systems, which create possibilities and can stimulate the transitions in other domains like industry, urbanization and agriculture. An example is the development of the Dutch Delta Works in the 1950s and 1960s. During the postwar decades, the Netherlands were facing multiple problems too, like a very weak industrial economy, a fragmented and inefficient agriculture, high poverty rates in the cities, an insufficient housing stock and a poor road system. In the first instance, the flood disaster of 1953 seemed to worsen the critical situation of the nation. But the Delta Works, planned and built in the years after 1953, were not only an answer to increasing flood risk, but contributed essentially to the economic and spatial resurrection of the country. Building the Delta Works offered not only a new flood defense system to the Southwest of the Netherlands, but was also an essential contribution to a new national transport system, which connected the isolated islands of the delta to each other, a new network of navigation routes, new industrial plants, a spatial reorganization of the agricultural land and a new framework for urban development. The building of the Delta Works was a catalyst in the transformation of the Netherlands from one over the poorest countries of North-Europa to one of the richest countries of he world. Moreover, after the economic crisis of the 1930s, the German occupation during World War II, the loss of the Dutch colonies in the East in the 1940s, and finally the flood disaster of 1953, the Delta Works contributed to a new collective idea of national identity and proudness.[46]

43 Meyer, 2019
44 Braudel, 1966
45 McHarg, 1969
46 Meyer, 2017

This example is relevant for the current context, in the sense that we should try not only to pay attention to the short term problems of a necessary change of the water system, but also on the long term benefits for spatial, economic and cultural transitions.

47 See also Meyer et al., 2020

Adaptivity

A big difference between the Delta Work and the current need to change the water systems, is the need to make the water system *adaptive,* that means that it should be prepared not only for current changes in conditions like sea level rise, but also for future, still uncertain changes. The water system should be able to deal with the capricious and unpredictable character of climate change, sea level rise and river discharges. While the Delta Works are an expression of 'Einsteinian' paradigm of the industrial society, focusing on exploiting and controlling the natural system, we need a more 'Darwinistic' approach, which takes into account the evolutionary character of natural as well as societal systems. The classical method for making systems adaptive, is creating *redundancy*. This is not only a classical rule in water management, but also in construction-engineering and urbanism. Before it was possible to calculate the load of floors of buildings and the strength of beams, it was common practice to apply oversized beams. They assured that the building would stay upright, also when the way of use and the load of the floors would change in the future. In 19th century urbanism, it was usual to design oversized streets and boulevards, prepared for changes and intensification of traffic and other ways of use of public space[47]. Also the most important aspect of the Room for the River program is creating redundancy, by making oversized river beds, bypasses and overflow areas. An important question in all these examples is how redundant elements or areas can get a value, also when they are not in use for their primary function? How can oversized beams in buildings, oversized streets in cities, or oversized riverbeds in landscapes be accepted, also when the redundant space is used only once in ten years? This is a question of smart design as well as smart temporary use. The research project IPDD ('Integrated Planning and Design in the Delta') developed a set of design-principles, which combine redundant space for high water events with temporary use as agricultural area, woodlands, recreational landscape or a combination of these types of land use. Only in periods of critical high water events, the redundant space will be in use as overflow areas for the river water, and the land users know that and are supposed to be prepared to deal with this temporary disturbance.

figure 10 — page 35


Design as an explorative method

The question how to deal with the need of creating redundancy and flexibility is directly related with the need of a strong role of design as a method of exploring new possibilities for land use and cultural value. While the 'Einsteinian' approach presented proposals for new dikes and dams as the inevitable results of exact calculations, to be implemented in a hierarchical decision making system, a more 'Darwinistic' approach supposes a more exploring and scanning procedure, in which the contribution of creative designers is indispensable, as well as an open attitude of involved decision-making institutions, citizens and other stakeholders. This is not

a change from a previous 'top-down' decision-making system towards a new 'bottom-up' organized process. The complexity of the water systems in relation with other big tasks in spatial development cannot be approached by a new centralistic 'top-down' approach nor by only new 'bottom-up' procedures. The point is that we should find new balances between aspects which should be explored and finally decided at a large scale, and aspects which should be explored and decided at a small, local scale. This makes it necessary that designers and planners are able to 'switch between the scales' constantly, and that governance systems are able to deal with this 'switching between the scales'. As an example, again, we can refer to the Room for the River program. This program was led by a central program direction, which had defined some very general rules, like the minimum capacity of the river bed for water discharge, and some starting points for ecological and spatial quality. Next to this, forty projects were defined to be designed and implemented by local teams of water managers, engineers, landscape and urban designers, environmental scientists, related with local stakeholders like city administrations, civic organizations, famers, recreational entrepreneurs, etcetera. The elaboration of the local projects was discussed with the 'Quality Team' of the central program organization frequently[48]. In this context, it was possible to adapt proposals of the local teams to the general rules of the program, but also to adapt the general rules of the program to new findings and inventions of local teams. It resulted also in new governance arrangements for the implementation and long term management of the projects.

Design as an explorative method and the organization of new governance arrangements are not two different fields of discussion but closely connected to each other: new results of the design process often suppose new governance arrangements, and vice versa.

48 Klijn et al., 2013; Sijmons et al., 2017

CONCLUDING REMARKS

'Delta Urbanism' is an example of a process of 'coming together' of different disciplines. Increasing collaboration of different disciplines, looking for new approaches to complex issues with high societal impact, is happening everywhere in the current world. It has become clear that the current division of academic and professional work in many different disciplines shouldn't result in a complete isolation of these disciplines. Instead of an isolation in separated 'silos', disciplines should learn to work together and to find new ways of interdisciplinary research and development. Everywhere in the world, universities, public bodies as well as private firms are experimenting with working in interdisciplinary teams. It doesn't mean that a discipline has to deny and abolish its own body of knowledge, methods and theories, but it does mean that each discipline is aware of its own limitations, and is able to communicate, exchange information and create added value together with other disciplines. This working together is essential to reach a more 'Darwinistic' approach to evolutionary processes, which enables us to see the coherence and mutual influences of different disciplinary fields instead of staring blindly to the maximum score in each separated discipline.

'Delta Urbanism' shows that this development of interdisciplinary work is an evolutionary process, which will probably never end in a final method. Delta Urbanism shows that, after 25 years, we are able to define

some essential aspects and starting points, as explained in the previous paragraph. For the next 25 years, the task is to elaborate these starting points in clear methods and solutions.

REFERENCE

Alexander, C. (1977). A Pattern Language: Towns, Buildings, Construction. Oxford: Oxford University Press

Bacchin, T. (2015). Performative Nature. Urban landscape infrastructure design in water sensitive cities. Delft: TU Delft/ Unesco IHE

Bobbink, I. (2016). De landschapsarchitectuur van het polder-boezemsysteem. Structuur en vorm van waterstelsel, waterpatroon en waterwerk in het Nederlandse laagland. [The landscape architecture of the polder-bosom system. Structure and form of water system, water pattern and water work in the Dutch low lands]. Delft: A+BE

Bosma, K. (1993). Ruimte voor de nieuwe tijd. Vormgeving van de Nederlandse regio 1900-1945. [Room for a new era. Design of the Dutch region 1900-1945]. NAi Uitgevers, Rotterdam

Brand, N., Kersten, I., Pot, R., & Warmerdam, M., (2014). Research by Design on the Dutch Coastline: Bridging Flood Control and Spatial Quality. In: Built Environment 40/2, 281-299

Braudel, F. (1966). La Méditerranée et le monde méditerranéen à l'époque de Philippe II. Paris: Librairie Armand Colin

Caro, R. (1974). The power broker. Robert Moses and the Fall of New Yok. New York: Vintage Books

Castells, M. (1972). La Question Urbaine. Paris: Maspero

Chung, C.K. (2014). Transformations of an Urbanising Delta Landscape. An Historic Examination of Dealing with the Impacts of Climate Change for the Kaoping River Delta in Taiwan. Delft: A+BE

Delta committee (2008). Working together with water. A living land builds for its future. Findings of the Deltacommissie 2008. The Hague: Delta committee

De Meulder, B., & Shannon, K. (eds) (2013). Water Urbanisms East. Explorations of Urbanism #3. Zürich: Park Books

Hooimeijer, F. (2014). The Making of Polder Cities. A Fine Dutch Tradition. Prinsenbeek: JapSam books

Hooimeijer, F., Meyer, H., & Nienhuis, A. (2005). Atlas of Dutch Water Cities. Nijmegen: SUN

Jacobs, J. (1961). The Death and Life of Great American Cities. New York: Vintage Books

Klijn, F., de Bruin, D., de Hoog, M.C., Jansen, S., & Sijmons, D.F. (2013). Design quality of room-for-the-river measures in the Netherlands: role and assessment of the quality team (Q-team). International Journal of River Basin Management, 11 #3: 287-299

Kothuis, B.L.M., Brand, A.D., Sebastian, A.G., Nillesen, A.L., & Jonkman, S.N. (eds) (2015). Delft Delta Design. Houston Galveston By Region, Texas USA. Delft: Delft University Publishers

Kothuis, B.L.M., & Kok, M. (eds) (2017). Integral Design of Multifunctional Flood Defenses. Multidisciplinary approaches & examples. Delft: Delft University Publishers

McHarg, I. (1969). Design with Nature. New York: Natural History Press

Meadows, D., Meadows, D.L., Randers, J., & W.W. Behrens III (1972). The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind. New York: Potomac Associates – Universe books

Meyer, H. (1996). De Stad en de Haven. Stedenbouw als culturele opgave. London, Barcelona, New York, Rotterdam. Utrecht: Jan van Arkel. English edition 1999: City and Port; Transformation of Port Cities. London, Barcelona, New York, Rotterdam. Utrecht: International Books

Meyer, H. (ed) (2003). Transformaties van het Stedelijk Landschap. Het werk van Palmboom & van den Bout stedenbouwkundigen [Transformations of the Urban Landscape. The work of Palmboom & van den Bout stedenbouwkundigen]. Nijmegen: SUN

Meyer, H., & Nijhuis, S. (2013). Delta Urbanism: planning and design in urbanized deltas – comparing the Dutch delta with the Mississippi River delta, Journal of Urbanism #6/2 p. 160-191

Meyer, H., & Nijhuis, S. (2013). Urbanizing deltas in transition. Amsterdam: Techne Press

Meyer, H., & Peters, R. (2016). A plea for putting the issue of Urbanizing Deltas on the New Urban Agenda. Delft: Delta Alliance/TU Delft

Meyer, H. (2017). The State of the Delta. Engineering, urban development and nation building in the Netherlands. Nijmegen: VanTilt

Meyer, H. (2019). Sustainable delta landscapes need smarter port city regions. PORTUS plus - Journal of RETE, nr 8.

Meyer H., Bregt, A., Dammers, E., & Edelenbos, J. (eds) (2015). New perspectives on urbanizing deltas. A complex adaptive systems approach to planning and design. Amsterdam: MUST Publishers

Meyer, H., Hoektra, M.J., & Westrik, J. (2020). Urbanism. Fundamentals and Prospects. Amsterdam: Boom

Mitchell, M. (2009). Complexity: A guided tour. Oxford: Oxford University Press

Mitchell, S.D. (2009). Unsimple Truths: Science, Complexity and Policy. Chicago: University of Chicago Press

Moudon, A.V. (1994). Getting to know the built landscape: typomorphology. In: K. Franck, L. Schneekloth (eds). Ordering Space: Types in Architecture and Design. New York: Van Rostrand Reinhold

Mumford, L. (1961). The City in History. New York: Harcourt, Brace & World

Nillesen, A.L., Kothuis, B.L.M., Meyer, H., Palmboom, F. (2016). Delta Interventions. Design and Engineering in Urban Water Landscapes. Delft: Delft University Publishers

Nillesen, A.L. (2019). Spatial quality as a decisive criterion in flood risk strategies. An integral approach for flood risk management strategy development, with spatial quality as an ex-ante criterion. Delft: A+BE

Palmboom, F. (2018). IJsselmeer - a spatial perspective. VanTilt, Nijmegen

Panerai, P., Castex, J., & Depaule, J.C. (1975). Formes Urbaines. De l'îlot à la barre. Marseille: Parenthèses

Portugali, J., Meyer, H., Stolk, E., & Tan, E. (2012). Complexity Theories of Cities Have Come of Age. An overview with implications to urban planning and design. Berlin: Springer

Portugali, J., & Stolk, E. (2016). Complexity, Cognition, Urban Planning and Design. Post-proceedings of the 2nd Delft International Conference. Berlin: Springer

Redeker, C. (2013). Rhine Cities. Urban Flood Integration (UFI). Delft, PhD thesis

Saris, F. (2010). Darwin meets Einstein. On the making of science. Amsterdam: Amsterdam University Press

Sijmons, D., Feddes, Y., Feddes, F., & Luiten, E. (2017). Room for the River. Safe and attractive landscapes. Wageningen: Blauwdruk

Tai, Y. (2018). Changing values on water in delta cities. The case of Guanghzou in China's Pearl River Delta. Delft: A+BE

Van der Cammen, H., & De Klerk, L. (2012). The Selfmade Land; Culture and Evolution of Urban and Regional Planning in the Netherlands. Unieboek/Het Spectrum, Houten/Antwerpen

Van Veelen, P. (2016). Adaptive planning for resilient coastal waterfronts. Linking flood risk reduction with urban development in Rotterdam and New York City, Delft: A+BE

Vigano, P., & Secchi, B. (eds) (2016). Water and Asphalt. The Project of Isotropy. Explorations on Urbanism #7. Zürich: Park Books

Wagenaar, C. (1992). Welvaartstad in wording. De wederopbouw van Rotterdam 1940-1952 [Welfare city in the making. The reconstruction of Rotterdam 1940-1952]. Rotterdam: NAi uitgevers

Waggonner+Ball Architects (eds). (2013) Greater New Orleans Urban Water Plan. New Orleans: Greater New Orleans Inc., 2013 (see also www.livingwithwater.com).

Wolf, A. (2015). The Invention of Nature: Alexander von Humboldt's New World. New York: Alfred A. Knopf

Zagare, V.M.E. (2018). Towards a method of participatory planning in an emerging metropolitan delta in the context of climate change. The case of Lower Paraná Delta. Argentina, Delft: A+BE

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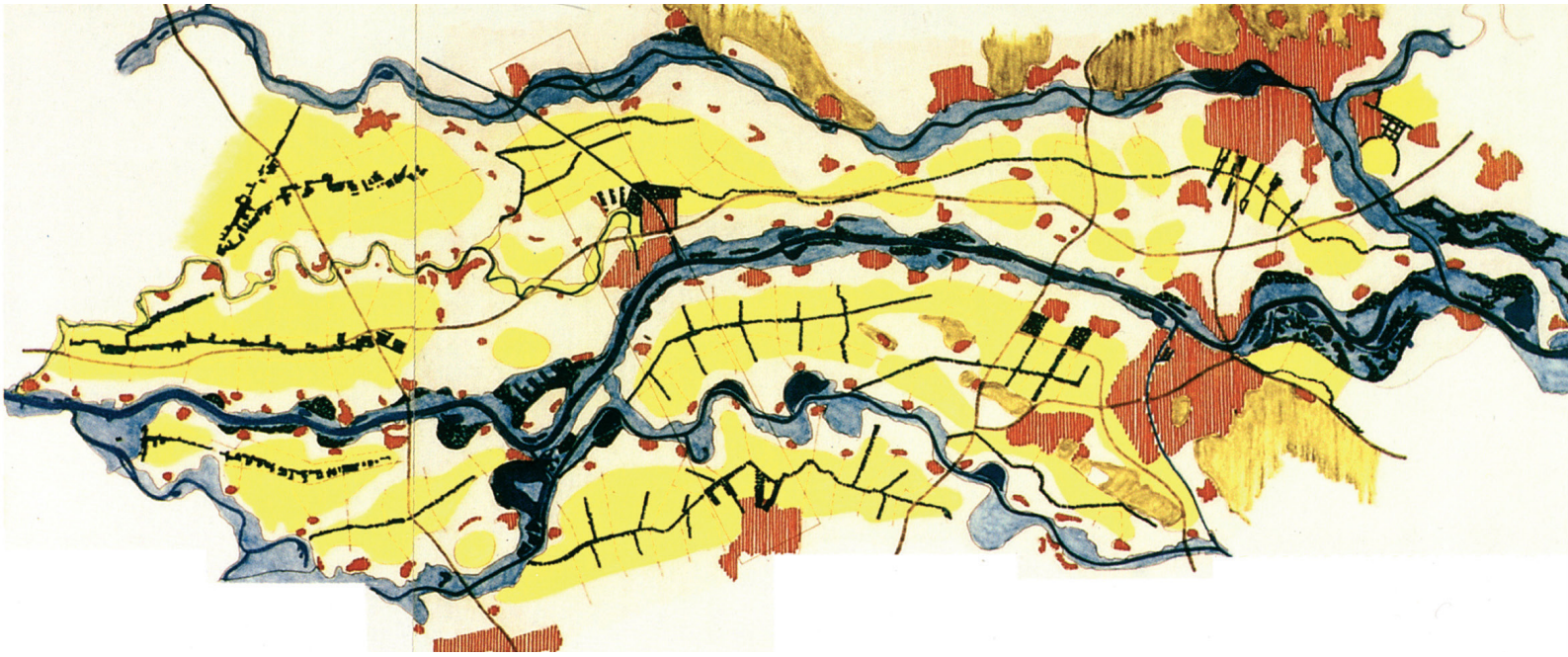


02

01 Protest against air pollution by oil industries in Rotterdam region, 1970. Photo Herbert Behrens, National Archive (public domain).

02 'Plan Stork', winning entry for the design competition 'The future of the river land' by the Eo Wijers foundation, 1986. Design by D. de Bruin, D. Hamhuis, L. van Nieuwenhuijze, W. Overmars, D. Sijmons, F. Vera.

03

04

03 Rotterdam in the 1980s: at the time the largest port city of the world, with an obsolete housing stock.
Photo by Piet Rook.

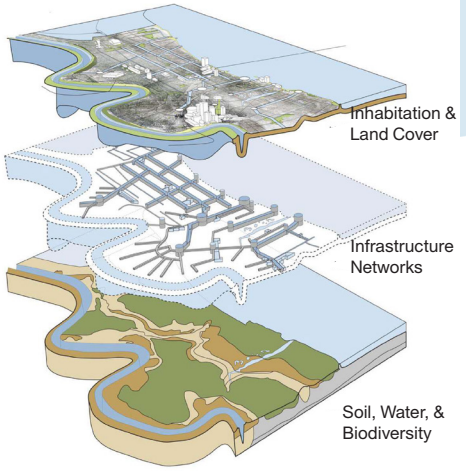
04 Analysis of the Rotterdam river landscape, as a leading motive for the design of new urban patterns. City planning department Rotterdam, 1990.
Drawing by Paul Achterberg.

05

05 Extreme high water event in the Dutch river area, February 1995.
Photo by Rijkswaterstaat.

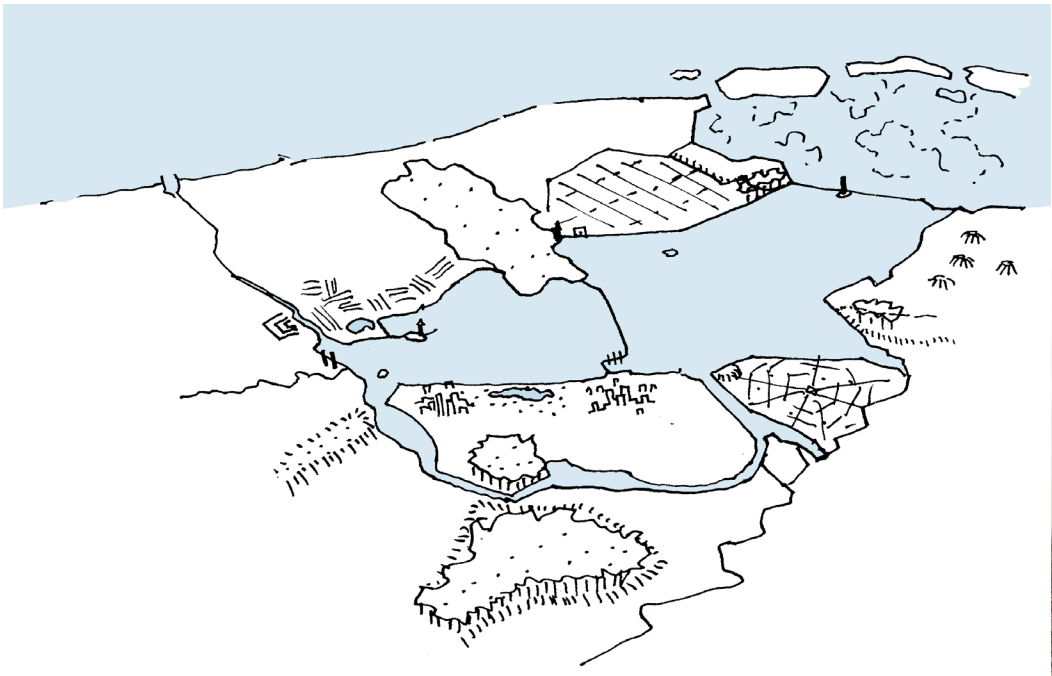
06

06 Program Room for the River. Indication of intervention projects. Map by program team Room for the River, 2005.



Layered Planning Process
Working from the ground up to determine how to integrate the natural flows of the landscape into infrastructure networks and the physical shape of our communities

07



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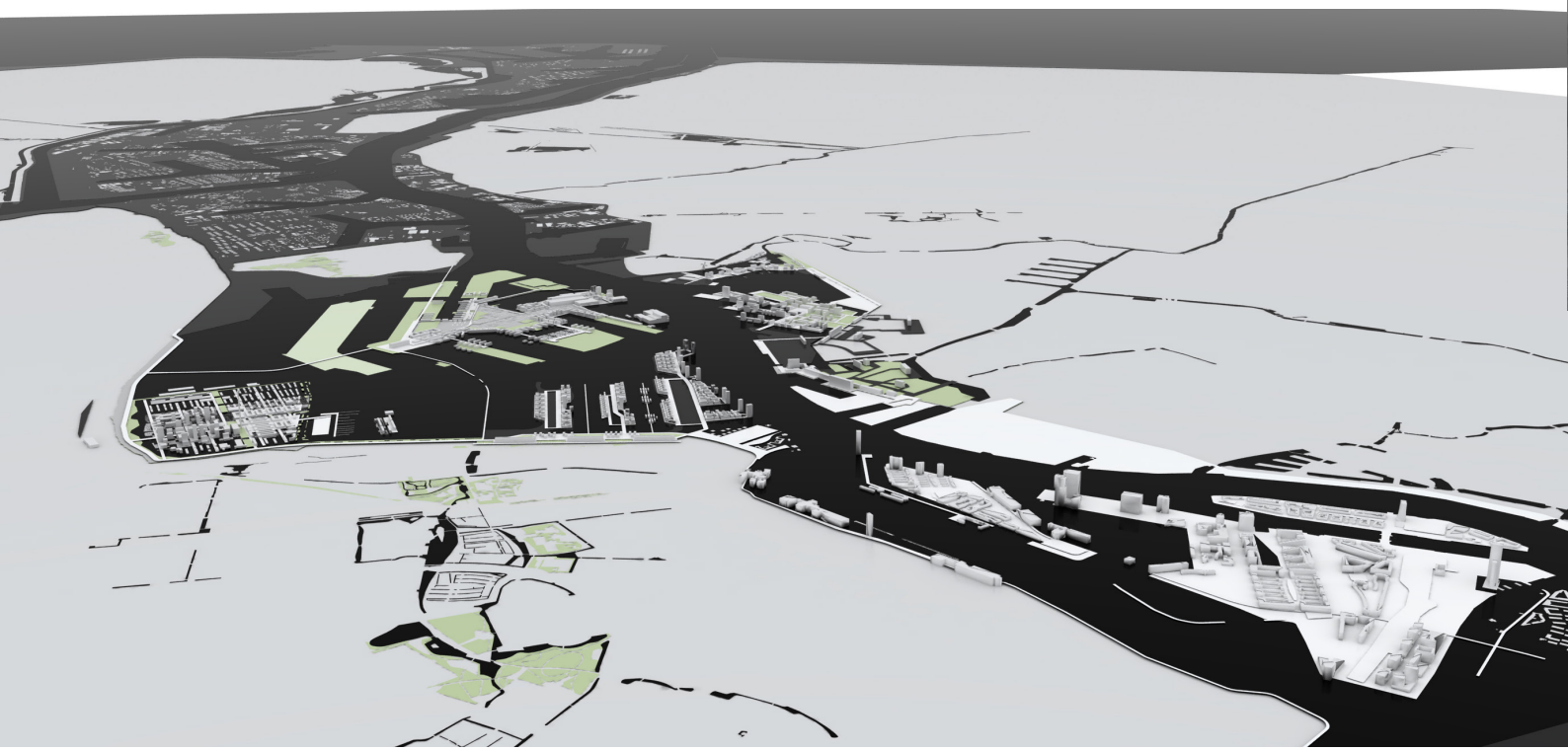
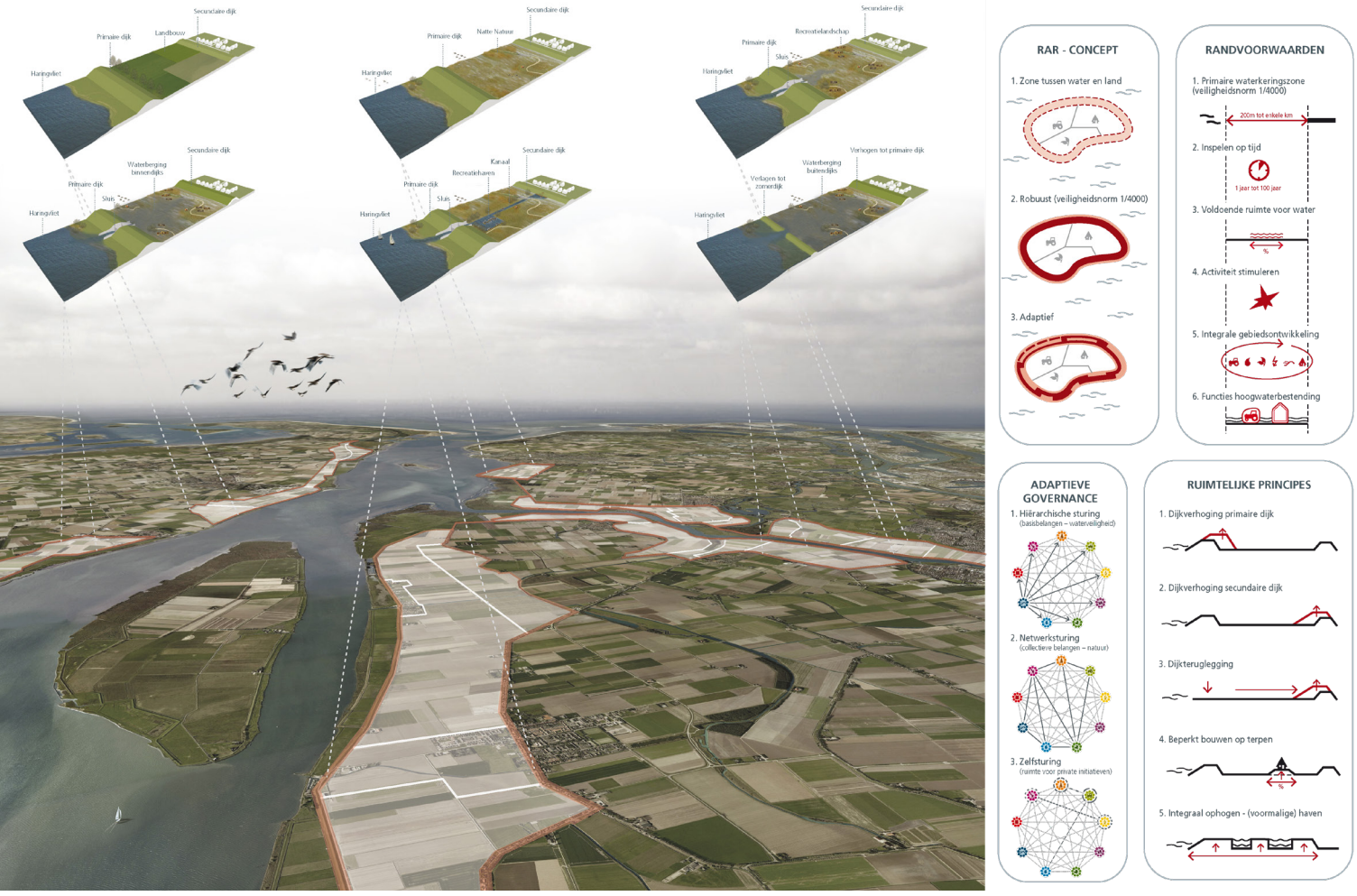


08

07 New Orleans as a complex system, composed by different layers: the landscape of the substratum (bottom), the network of hydraulic infrastructures (middle), the urban pattern (top). Greater New Orleans Urban Water Plan, 2013. Drawing by Waggonner+Ball Architects, New Orleans.

08 Design exploration of a possible future of the city of Rotterdam in times of extremely high sea levels. TU Delft, EMU project 'Constructing the sustainable delta city', 2011.

09 The IJsselmeer area as a 'metropolitan breath of fresh air'. Drawing by Paul Broekhuisen and Frits Palmboom.



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10 Design rules for a 'robust adaptive framework' in the Dutch Southwest delta, combining redundancy for flood control with temporary use of flood zones. IPDD project, 2014.

Changes in the way we live and value urban spaces

Richard M. Ashley

Trends have been continuing for the majority of the world's population to live and work in urban areas. Despite numerous change factors, like climate, and gradual changes in the form and layout of urban spaces, towards for example, more use of nature in cities, urban areas continue to follow the form set in the past in industrialised countries, with little green space. In this Millennium, new financial models have been developed to value nature to ensure it is appropriately accounted for in the neoliberal economy. The links between welfare of residents and visitors to cities that are greener are now clear and understood to bring massive economic value. However, responses to the Covid-19 pandemic have changed the relationship between citizens and urban areas. Potentially fewer people will live and work in inner city areas, therefore the financial value of new green spaces in inner cities is likely to reduce. This paper considers the potential implications of the various change trends in how nature-based spaces can be financially valued in a post-Covid 19 world. Two case examples show how: (i) better value may possibly be obtained by restoring a brownfield site in Sweden to natural forest, rather than building new housing; (ii) the financial value of greening London to manage stormwater may reduce due to people preferring to live in suburbia rather than the centre. Overall, the importance of carrying out a 'futures' assessment using scenario planning or an equivalent process when valuing the greening of urban spaces is emphasised in the light of the ongoing challenges.

INTRODUCTION

Urban living is now the norm for the majority of the world's citizens. Yet, the dominant form of major urban areas remains as developed during the industrial revolution in western countries. Comprising of mainly densely packed buildings and paved areas, typically dominated by roads around which travellers, dwellers and visitors have to navigate. Soil sealing is typical on the ground surface, with limited unsealed green or blue (water) spaces. Obviously two-dimensional in horizontal spaces, the below and above ground third dimension is also heavily built. All spaces are valuable in this three dimensional urban area, even those below ground: "*The chief function of London today, it would seem, is to convert space in to money*"[1]. 'Place' and place value are recurring themes in contemporary urbanism. Whilst there are difficulties in quantifying the 'quality of the built environment', it is now possible to quantify the value of many of the services provided by the form and components used in the built environment; i.e. 'place value' alongside the less tangible 'place quality'[2].

Since the Millennium Ecosystem Assessment (MEA), there has been confirmation of what was long believed, that not only are built spaces financially valuable, but also the urban spaces without buildings or with unsealed surfaces can be extremely valuable for the ecosystem services (ES) they provide. For example, Costanza et al. (2014) estimated the overall global value of ES at some $145tn/yr in 2011. There is a continually growing body of evidence for the major contribution that ES can provide in servicing urban areas for e.g. amenity, flood control, human health etc.[3]

Although global estimates like this are difficult to engage with at a local level, there has been a surge in valuations of urban space ES and estimates of natural capital across the world. For example, in London the natural capital provided from the public parks, comprising one fifth of the urban area, has been estimated in excess of £91 billion[4]. By far the greatest proportion of this value, 61%, was in benefiting residential properties. The ramifications of this financial valuation of 'all spaces' for urbanism at various physical and jurisdictional scales[5] are still being played out. However, the consequences of 'putting a value on nature' are being found to be both positive in providing more information, but also potentially negative, for example by: (i) adding complexity to the already complex decision making process in land use planning[6]; (ii) skewing preferences for selection of measures to be used and in supporting particular types of ES and blue or green infrastructure[7]; (iii) in gentrifying parts of urban areas[8]; (iv) in demonstrating who benefits and in consequence, who should pay for these benefits[9]. Thus the financial valuation of ES and natural capital accounting is complicating the deliberative processes involved in urbanism.

This is the theme of this paper which considers the place of valuation of ES in the form of provision or support and maintenance of blue-green infrastructure (BGI) in the changes to urban areas, and especially to urban spaces. Such changes are considered here as potentially truly transformative in the move from today's unsustainable cities, to urban living that is more natural, safe, liveable and meaningful. With spaces that help make urban living more resilient and agile in responding to the very significant challenges faced by urban space dwellers and users into the future[10]. The setting of how a key utility, water, is managed in urban areas is used to illustrate the potential for effective change and also the potential to

1 Heathcote, 2016
2 e.g. Carmona, 2019
3 e.g. Fenner & Digman, 2020
4 Vivideconomics, 2017
5 e.g. Chini et al., 2017
6 e.g. Blečić & Cecchini, 2020
7 e.g. Russo et al., 2019
8 e.g. Meya, 2020; Pearsall & Eller, 2020
9 Ashley et al., 2018
10 Elmqvist et al., 2019

resist the changes needed to transform urban areas into those needed for future towns and cities. As the author has had a long career in urban water engineering, the paper has a background and is contextualised in the management of urban water. A relevant overview of how urban water has been managed traditionally and may be changing is given in Ashley et al. (2020).

Following an initial brief review of the condition and change drivers for why and how urban areas may need to change. One of the main vehicles that has emerged for bringing the changes about is outlined, that of financial valuation of ES, and the spaces that accommodate ES and natural capital. Financial valuation is a necessity when promoting change under the neoliberal economic model that defines and contextualises life in developed urban areas[11] and is at the heart of arresting environmental degradation: "*Politicians' 'historic disregard for the destruction of nature' has left the UK vulnerable to environmental breakdown and only major 'transformation of society and the economy' will bring the country to some semblance of sustainability*" [12]. New tools are allowing BGI, and nature to be financially valued. Examples of financial assessment from Sweden and the UK are used here to illustrate the very significant value determined for BGI/ES in urban spaces. However, the Covid 19 pandemic is challenging many of the assumptions of use-value of BGI/ES to people. This paper provides an example of the pre and post-Covid 19 valuation of BGI retrofit in London for dealing with stormwater problems. It would also be interesting to assess the equivalent value of the future of BGI for the delta in which Greater London is situated, however, this is beyond the scope of this paper.

Finally, the implications for urbanism are considered, especially for land use planning and thus for policy and decision makers. Can financial valuation of urban spaces be part of the means to break the stranglehold of the closed mindset that is inhibiting the needed, and increasingly expected transformation of urban areas into better places? Or does a financial mindset direct urbanism down an unintended road?

TRADITION AND CHANGE

Historical urban centres like Paris and London have long-established buildings and fundamental services maintained and renewed as needed. This includes long established designated 'spaces', like the parks, watercourses, and other areas where natural systems can maintain a degree of 'naturalness'. This contrasts with many parts of the world where development is not controlled and urbanisation proceeds virtually unchecked often in a haphazard fashion[13], and where services and infrastructure are often poorly maintained. Whereas countries such as those in the EU or North America have developed urban land use planning systems that utilise institutionalised regulatory frameworks to ensure that development is controlled in conformity with strategic and other plans. This paper focuses on these urban centres, where there are potentially the greatest opportunities for controlled change, although there are lessons for developing country urbanism.

Traditional urban water systems have served developed areas well for two Millennia, but are now increasingly unaffordable to both maintain and also to enhance so as to be provided in a way that is likely to be as sustainable as possible. Even in wealthy cities in the USA, the costs of

11 e.g. Ginn, 2020
12 Laybourn-Langton, 2020
13 e.g. Karaman et al., 2020

water service provision are increasingly unpayable by citizens, especially as these costs continue to escalate dramatically[14]. Changes are needed and are gradually happening in the way in which water and others services are being provided, with moves away from large centralised to more localised systems[15].

We are all familiar with gradual changes in our urban spaces and evidence that 'greening' is now a well-established gradual process[16], but to cope with the considerable challenges we now face, transformational change[17] is needed if humanity is to survive in settlements with a form at least bearing some resemblance to what we have today, and at a pace similar to that of the great sanitation revolution of the 1800s[18]. Many reviews of the changes needed to address our current climate, environmental and social problems, point to change needing to be 'big', transformational and fast[19]. Notwithstanding the lack of consensual methods, ideas and theories as to what the changes need to be and how to effect these, possibly the greatest barrier identified may be mindsets[20]. Mindset issues sit alongside silo thinking and working, in that those charged with policy making, devising, planning, regulating, designing, providing and maintaining the essential societal systems and services, are unable or unwilling to change. In the past this was often a valuable attribute as it ensured that public health for example, was not compromised by too risky innovations[21]. But, given the scale and rapidity of the onset of today's societal challenges, mindsets that prevent or even delay the necessary innovations as part of trends for change, many of which are shown in, *figure 01 — page 55*  are at best limiting, and at worst, dangerous.

The failure to create or even define, cities that are sustainable[22], means that the best ways to plan and manage urban areas, spaces and people's experiences of these, is open to numerous interpretations. Having abandoned the 'sustainability mission', these interpretations fixate on 'the new paradigm', which includes, amongst others: 'green'; 'resilient'; 'nature-based'; 'circular' as the various visions or components for the way to go[23]. There are also complementary aspirations about 'place quality'[24] that aim at urban form. These multifarious visions should not be denigrated, as they each can contribute to 'sustainable cities', even if we have no clear idea what such cities would comprise, although some are of the view that these need to be 'compact', and also include green spaces[25]. These ideas sit alongside the paradigm that nothing is of value if it cannot be monetised; i.e. the economic 'leg' of the tripartite components of sustainability has largely subsumed the social and environmental legs[26]. For a commentary on what 'value' of urban place may mean see Carmona (2019).

Urban greening has the potential to be transformational for our urban spaces. Greening has become seen to be a fundamental component of all frameworks for sustainable human living, such as the water sensitive city[27]. For this, liveability is a key attribute[28], even when considering the management of water in urban areas. In common with numerous other blue-green initiatives, the water sensitive cities programme has created an ES valuation tool called INFFEWS[29] that is being used to assess the financial value of blue-green infrastructure (BGI) in (mainly) urban spaces. Other tools are also available for this type of assessment and will be introduced later in this paper. Such ability to undertake financial valuation of BGI (and spaces) has the potential to be truly

14 Colton, 2020
15 Ashley et al., 2020
16 e.g. Feng & Tan, 2017
17 e.g. Elmqvist et al., 2019
18 Geels, 2006
19 e.g. Polsky, 2019; Elmqvist et al., 2019
20 ibid.
21 e.g. Allen, 2008
22 Elmqvist et al., 2019
23 Ashley et al., 2020
24 Carmona, 2019
25 Bibri, 2020
26 ibid.
27 Brown et al., 2009; see also: https://watersensitivecities.org.au/
28 Sochacka et al., 2020
29 https://watersensitivecities.org.au wp-content/uploads/2019/02/IndustryNoteINFFEWS-Value-Tool_V3.pdf

transformational for urbanism, as it conforms with the neoliberal economic mindset. The use of the Center for Neighborhood Technology valuation tool in the early 2000s[30], helped to demonstrate the very significant financial value of using BGI (defined as green stormwater infrastructure, GSI) for stormwater management in the City of Philadelphia; originally estimated as adding $2.6bn in value, and was instrumental in bringing about the green city programme there and elsewhere in the USA. *figure 02 — page 55*  Lauded as smart policy and smart business, the programme is transforming the look and liveability of the City [31]. The SBN (2016) five year review of progress found "*GSI represents a neighbourhood level amenity that provides a wide range of quality of life benefits, stabilizing home values, growing the city's property tax base, and making possible more private investment throughout the city*". The latest estimate of the added value has risen to $4bn. The delivery of GSI itself as an industry is adding significant financial value in jobs and other benefits in Philadelphia.

Such valuations for using GSI in managing stormwater in Philadelphia present an almost irresistible incentive for politicians and decision makers to utilise NBS. But this only applies where the benefits are clearly accrued to those funding such schemes, or where societal benefits as a whole are sought. The use of these new valuation tools is demonstrating that there are numerous categories of benefits from using NBS (from the groups of ES and other social value). For example in benefiting human health or elevating property prices, even where a scheme aims to reduce flooding[32]. Making the connections from the beneficiaries of a particular benefit category to those in society who receive funding and are responsible for effecting societal change, is often not straightforward, especially as there are many and "…*diverse forms of value generated as a consequence of how places are shaped.*"[33]

This needs to be set in the context of the change trends in *Figure 01*, that are altering urban spaces, and requiring urbanism responses[34]. Including ensuring healthier and safer agglomerations[35]. Changes in urbanism have been ongoing even before the shock of the Covid-19 pandemic[36]. Significant initiatives were already underway in the developed world to alter policies and the configuration and use of urban spaces[37]. The big drivers include initiatives to move to zero carbon, integrated systems, services and circularity[38]. There are also more local (planning) level initiatives, for example: (i) New Urbanism, aiming to create more walkable and accessible spaces with human-scaled design as part of the enhancement of human health[39]; (ii) constraining the motor vehicle domination of towns and cities with more urban spaces becoming free of routine traffic[40]; and (iii) new philosophies of urban living and hence spaces are emerging, such as meaning-making[41]. Other change trends are shown in *Figure 01.*

Historical outbreaks of infectious diseases were one of the main reasons for how and why urban areas were significantly restructured in the 19th Century, with improvements to the sanitary conditions also providing a platform for major land use change, with massive demolition and remodelling of cities like London[42]. Similarly, cities' transport systems have developed from horses to mixed modes of private and public vehicles, individual and mass transit. In future, fewer private vehicles, many autonomous, will reduce the need for roads, opening up spaces currently sealed[43], providing new opportunities for greening. But with fewer commuters and

30 Fenner & Digman, 2020
31 Muroff & Shipp, 2019
32 e.g. Ashley et al., 2018; Fenner & Digman, 2020
33 Carmona, 2019
34 e.g. Hobbie & Grimm, 2020
35 e.g. Iravani and Rao, 2020
36 Helm, 2020
37 e.g. Watts et al., 2015
38 Ashley et al., 2020; UK Government, 2020
39 Iravani & Rao, 2020
40 e.g. Drury, 2020
41 Yeoman et al., 2019
42 e.g. Allen, 2008

daily visitors, there will be less people to appreciate and engage with the green spaces and their value will be less than before the Covid 19 pandemic. In the post-Covid 19 city, we should expect many of the change trends to accelerate, especially the diverging differentiation between those who can work at home and those who have to attend an urban workplace. The Covid 19 pandemic has also highlighted the need to be more aware of crises and planning urban areas for these, by for example, being able to limit population movements in public places when necessary[44]. How then can we value urban spaces in the light of these changes and exigencies? Prior to the Covid 19 pandemic it seemed straightforward to use ES valuations for the benefits provided by nature to people in towns. But with the shifting perspective that the pandemic has brought, the tools and processes being used before may need some rethinking to remain applicable.

Covid 19 may be the change agent that reverses the 20th and 21st Century attraction of populations into urban areas[45]. This contrasts with the other major change factor, climate, which is a slower impacting process and for many people, seems not to be so relevant for how urban spaces need to be formed and managed. Even the most detailed scenario planning processes fail to postulate the potential for a major pandemic like Covid 19 in visions of coherent futures[46]. Precisely which type of water and sanitation system can provide the best security against future pandemics? Trends to utilise on-the-surface stormwater drainage systems, direct water use, recycling and other 'non-traditional' systems, including BGI, moving away from the large centralised networks that are standard in the developed world, need to consider if they can accommodate the risks of future Covid-like pandemics. There are numerous other change trends shown in *Figure 01* that will and are changing urbanism. Here the paper concentrates on those trends deemed to be of greatest significance for the valuation of BGI and implications for urban spaces, shown in Table 1.

Although the change factors in Table 1 are shown individually, in practice these will overlap and interact, it will be the aggregation that will influence the future way in which BGI is valued. With post-Covid 19 urban-

43 e.g. Fagnant & Kockelman, 2014
44 Pisano, 2020
45 e.g. Cotella & Brovarone, 2020
46 e.g. Maier et al., 2016

Table 1 | Principal change trends that may influence the value of BGI in urban areas in developed countries

Change factor	Implications for urbanism and the value of added BGI	Timescale of influence	Trend in value of urban BGI compared with today
Covid-19 and similar health impacts	More remote working with fewer urban visitors (e.g. Errichiello & Demarco, 2020). More people using green spaces doing this and possibly valuing it more especially for health and wellbeing (EEA, 2020). Propitious to rethink time and spaces of the city; alteration in urban living, or return to 'normal'; places of being together transformed; public transport brings greater risks than individual vehicles; building densities need to be 'thinned-out' (Fistola & Borri, 2020). More opportunities for BGI but likely to be of less value than for pre-Covid urban spaces.	Acute (statistically unpredictable) to longer – term in urban planning processes.	Reduces
Climate change	Increasing heat and intensity of rainfall in urban areas will promote the need for soil unsealing and BGI (e.g. Kron et al., 2019). Sea level rise and storminess will especiallly affect coastal and delta urban areas. Value of BGI/NBS will potentially increase.	Chronic (semi-predictable)	Increases
Autonomous vehicles	Likely to reduce individual journeys, and sealed surface spaces significantly, but increase shared journeys (Fagnant & Kockelman, 2014), potentially increasing infection risks but reducing noise, water and air pollution and accidents. Many more opportunities for BGI but it is likely to be of less	Medium to long term (predictable)	Increases initially then reduces over time

	value than today due to proximity and widespread use in outer urban areas. The main benefit will be for carbon sequestration which will increase value significantly.		
Lifestyles (including population trends, consumption patterns)	Urban centres no longer retail hubs. More remote working and living, return to rural living or outer fringes of urban areas. Fewer people commuting (Osborne, 2020). Potential depopulation of existing cities, although this may be offset by turning inner-city office and retail space into dwellings. Less passer-by shopping and potentially less consumption (e.g. Lai et al., 2020). More people likely to be in areas with widespread ambient BGI, hence any new BGI is likely to have less value although it will be accessed more in these areas.	Continuous	Reduces

ism being 'restored' to some sort of normality based on individual country and regional priorities, probably under neoliberalism, economic vitality is still likely to be the biggest driver[47]. Hence the four main factors shown need to be considered inter-dependently, along with the other change trends shown in *Figure 01*.

47 e.g. Lai et al., 2020
48 e.g. Emery, 1986
49 Thurston, 2012
50 Sukhdev et al., 2010
51 e.g. European Investment Bank, 2020
52 e.g. Fenner & Digman, 2020
53 CIRIA, 2020

VALUING URBAN SPACES

The current promotion of 'nature in towns' can be traced to the mid to latter 20th Century, when the concepts were considered as self-evidently useful for 'conservation' and an effective means of supporting ecosystems, even in urban spaces[48]. There have been numerous recent studies purporting to show the value of green or blue spaces, including 'nature' (few have looked at the value of brownfield spaces). These are aimed at 'blue' or 'green infrastructure' (BGI), and how natural systems provide services to humanity. BGI has become subsumed into the concept of 'nature-based-solutions' (NBS) in general, and is costed and valued in much the same way as traditional grey infrastructure[49]; i.e. what financial value do BGI/NBS provide? After the Millennium Ecosystem Assessment, putting a financial value on 'nature'[50], complying with the tenets of neoliberal economics, nature has a 'cannot-be-ignored' seat at the policy and decision making table. Now the utilisation and support of and to ecosystem services (ES) as part of urban infrastructure provision has become the norm and actively promoted as sound investments[51].

Two examples of how BGI has been financially valued are outlined below, also illustrating the potential implications of how valuing urban nature may change in a post-Covid 19 society.

EXAMPLES OF THE VALUATION OF BGI/NBS

There are numerous tools and examples of valuations of BGI related to managing surface water in urban areas[52]. Here, examples are outlined from using the CIRIA B£ST tool[53] which utilises ES valuation. Details of the valuation approach and benefit categories are explained in the technical guidance and also in Ashley et al. (2018) and CIRIA (2020). Most of the published examples of financial valuation of BGI (as well as B£ST) consider the 'business-as-usual' (BAU) condition. In B£ST this is the current state of the development area, together with the 'standard' future predicted changes of environmental factors like climate and urban developments. Few examples show the importance of longer term scenario planning, where various

coherent futures are considered during the lifetime of a development which is typically 30 – 50 years for a BGI scheme. Ashley et al. (2018) provide examples to show how important scenario planning is to such schemes and how possible future changes can be considered in a formalised way.

Table 2 lists many of the benefits used in BGI valuation in B£ST, highlighting those that are directly derived from population usage or peoples' proximity to blue or green spaces (in grey). The proximity of BGI to people and properties and the amount of BGI already in an area affects the potential value of any added BGI[54]. However, B£ST does not account for this in valuations. The importance of proximity is illustrated by Morgan & Fenner (2017), for the blue-green cities tool where financial valuation is not used due to such proximity uncertainties. It would be expected that retrofitting BGI into dense urban spaces would bring the various benefits listed in Table 2, whereas in areas that are on the fringes of cities, or in suburbs, the value of new blue or green spaces will not be as great, as this may add only a small increase to the overall extent of existing BGI in such spaces. As yet there are no financial BGI valuation tools that make this distinction. Proximity, targeting new BGI to areas which are deficient in green spaces, will become increasingly important as cities become reorganised to cope with pandemic risks and climate change. Especially where there are the greatest numbers of people in centres or where there are heavily paved areas. However, where populations are moving to suburbs or to living and working in rural areas, BGI additions may be less valuable.

Table 2 provides a commentary on how the benefits from new BGI valued in B£ST could change in the future in a post-Covid 19 urban area based on the change trends in Table 1. The comments apply to the way in which B£ST estimates the benefits and may not therefore apply to other valuation tools. The last two columns relate to the London case study outlined later in this paper.

Two case examples are outlined here: (a) a new housing development surrounded by forest in Northern Sweden in a suburb of the City of Luleå; (b) the retrofit of BGI across greater London to manage stormwater to reduce the spill of combined sewer overflows into the River Thames. Only summary results are provided here, with further details of the Swedish case given in Hamann et al. (2020) and the London case is further elaborated in Stovin et al. (2013).

These case examples have been selected to illustrate particular aspects of the theme of this paper. The Swedish case considers the value of returning the original brownfield development site to nature, rather than developing housing, providing an example of returning an urban area to nature. The London case contrasts the ongoing construction of a new sewer tunnel in London with the value of using BGI as an alternative, similarly to Philadelphia's approach (see below) and is used to examine the potential change in financial value of BGI in the light of possible post-Covid 19 and the other changes to cities shown in Table 1. London is a 'controlled' delta city, subject to tidal cycles for most of the River Thames, this influences and is influenced by the way in which flooding and any storm and sanitary outfalls are managed. Currently the Thames Barrier is not used for tidal control and therefore London experiences the river like a delta or coastal city, with all the benefits for amenity and also the risks due to inundation. This situation has and does influence the form and development of urbanism in the city and greater region.

Table 2 | Benefit valuation categories used in B£ST, highlighting those directly dependent on population numbers and dwellings in grey, showing the potential implications for post-Covid 19 urban areas (key: BAU – business as usual; *30-50 year – multiplier factor on BAU)

Benefit category	Assessment factors in B£ST and relationship to population (dwellers, visitors or the wider community) BAU	Potential implications for post-Covid 19 urban areas for the change trends in Figure 01 and Table 1	Effects on BGI value as assessed in B£ST (all changes in Table 1) for London case study below Implications for the post Covid-19 London area (30-50 year timescale)	B£ST factor*
Air quality	Improvements are due to 1 Vegetative additions including green roofs 2 New trees of various size This benefit will both help human health and also mitigate climate change.	Opportunities for green roofs will be mainly on existing buildings. These will still continue. There may be more space for new trees as road extent is reduced.	Fewer people may benefit directly from pollution reduction if less are living in urban area, but overall benefits for climate may continue and become even more important. The decrease in value may be offset by the increase in latter importance.	1.
Amenity (Property Prices)	1 Number of homes overlooking (new) ponds. 2 Number of houses within proximity to parks (in different price categories).	If fewer people are living in urban areas, as less need to live near workplaces, then the value of properties normally increasing due to new BGI may reduce. Overall, B£ST presumes that property price benefits accrue mainly at the outset of the installation of BGI (Ashley et al., 2018a).	Property price benefits of new BGI could reduce over time or remain as for BAU, as BGI becomes more widespread and fewer people live in the city.	0.5
Amenity (excluding Property Prices)	1 Number of residents living in (new) green streets. 2 Estimated numbers visiting parks (NB overlaps with Health and recreation categories; need to avoid double counting).	As above, if there are fewer residents then the value of new BGI will be less. Also applies to park visits in urban areas.	Other amenity benefits may reduce due to fewer properties or population in urban centre.	0.5
Asset Performance - Pumping	The benefits arise due to reductions in energy for pumping and also in carbon impacts due to less stormwater needing to be pumped.	An indirect benefit that depends only on the pump operational time. Extensive BGI should reduce this, as will depaving of roads. With fewer people in city, this may reduce anyway.	Main likely value will be from the reduction in sealed surfaces, and opportunities for BGI in spaces. Value assumed as similar to BAU as relative significance assumed similar.	1
Asset Performance - Treating wastewater	Similar to the above, energy and carbon.	As above, as dependent on volumes treated.	As above	1
Biodiversity and ecology	Benefits depend on type and size of BGI and quality of the installation, not numbers of people. Wildlife will need linked green space corridors.	Should be more opportunity for green corridors following reduction in paved surfaces. Certainly more green and blue spaces.	B£ST does not value linked or otherwise corridors. Here it is assumed that this benefit may become more important in future due to climate change and effects on ambient species.	1.1
Building temperature	Assessed in terms of energy and carbon, however, type of property and energy modes are relevant. Thermal comfort not included. Not directly related to numbers of people.	Changes to building forms, compliance with energy and thermal standards may result in green roof benefits in this category becoming obsolete.	Could become more important due to urban heat island intensification but less valuable as building form changes. Assumed to reduce.	0,9
Carbon reduction and sequestration	Benefits arise from numbers and types of new trees, restored flood	Depopulation and depaving could pro-	Each of the potential BGI options might be feasible in London, includ-	1.5

	plains, and carbon stored in woodlands.	vide more opportunities for trees and woodlands and even floodplain restoration	ing floodplain restoration were the right conditions to arise. Here only new trees have been considered. The benefits may be even more important in offsetting climate change.	
Crime	Reductions in crime due to greening relate to the number of people affected. Value requires user input.	Likely to be fewer people affected.	A greener London with fewer people should mean that crime reduces, but fewer people will be subjected to the risk. However, valuing this is not feasible at this time	-
Education	Number of students visiting BGI.	May reduce, if there are fewer school students in city centres. Visits more likely in outer urban areas.	Value likely to reduce significantly.	0.5
Enabling development	The main benefit is in making space available by managing surface water. Value requires user input.	Development space may be freed up by reducing the amount of sealed surfaces. Hence BGI may in future not contribute significantly to this.	Not used, but could be important in future where paved surfaces removed, providing opportunities for new BGI.	-
Flooding	1 Number and types of properties no longer flooded; numbers of people affected need to be estimated from occupancy. 2 Reduction in hours lost in travel disruption, i.e. depends on road traffic 3 Health benefits of reduced stress (property numbers)	Changes to climate may bring greater flood risks. However, post-Covid and with autonomous vehicles there may be fewer journeys and those undertaken may readily avoid disruption.	Could become more important due to climate change increasing rainfall, but value offset by fewer people resident. Assumed to be less value than BAU in the future.	0.9
Health	1 Numbers of visits to green spaces: (i) physical activity; (ii) emotional wellbeing. 2 Number of adults with a view over green spaces.	1 If there are fewer people in urban areas the beneficiary numbers may reduce. 2 If depopulation occurs then there will be fewer adults with a view Overall there may be more people in suburban areas, many working from home. Any new BGI will not be as valuable as in dense city centres due to proximity of other green areas.	Gradual reduction in financial value in urban areas as more population in suburbs. Reducing value. The reduction in population likely in inner areas will reduce the value of this benefit.	0.9
Noise	Number of households likely to benefit from noise reductions. Depends on proximity and type of BGI.	Much noise is traffic related so with fewer vehicles (if autonomous), BGI will not provide as significant a contribution in abatement.	Number of households likely to benefit from noise reductions. Depends on proximity and type of BGI. This benefit is dependent on details of BGI, it has not been used in this overview valuation.	-
Recreation	Numbers of recreational visits.	As for health, overall there may be more people in suburban areas, many working from home. Any new BGI will not be as valuable as in dense city centres due to proximity of other green areas.	As this benefit overlaps with the health benefits it has not been used in this assessment to avoid double counting.	-

Tourism	Number of visits and visitor expenditure. Value requires user input.	Visitors may still be attracted to historic city centres in future. BGI will not significantly add to this.	Not used, but tourism could increase in London as centre less populated and easier to access.	-
Traffic calming	Reduction in numbers of traffic accidents will depend on vehicles and numbers of people.	Autonomous vehicles should make this benefit insignificant.	Reducing vehicle numbers may be offset in value due to population being smaller in urban areas..	0.9
Rainwater harvesting	Value from the reductions in property water charges, hence depends on numbers of properties affected may be substantial but are not included in the overall benefit value. Only reductions in pumping benefits from this are included in water quantity benefits.	With more home working, this may encourage more uptake of this. Likely that reducing the extent of sealed surfaces will contribute greater value than from harvesting.	Could become more important due to water stress in S.E. England. Future value as for BAU.	1.5
Water quality	Depends mainly on the improvements and river quality class changes.	New BGI will reduce the amount of stormwater discharged into rivers and improve the quality. Future opportunities for BGI will be greater.	BAU assumed as making the Thames good from moderate. Any further reductions in flow and quality benefits would only be expected to bring marginal added value.	1
Flows in watercourses	This is for the length of watercourse or area of waterbody	As above, the length of the watercourse will remain unchanged.	BAU will already have brought the benefits, as above.	1
Groundwater recharge	This is the value from providing an additional amount of groundwater from the infiltrating BGI.	Added green spaces will bring value under BAU. In future depaving will allow for more recharge.	BAU will bring notable benefits as the SE of England is prone to water stress. This will become more important in future under climate change.	1.5

Kronandalen housing development.

Luleå in northern Sweden has a steadily growing population (78,105 in 2019 up from 74,178 in 2010) and a commensurate demand for new housing. The Kronandalen suburban development area is some 3 km northeast of the city centre, and a military base until 1992. Close to a major forest and two large lakes; the main recreational area of Luleå. Development will create a dense urban area of 2,200 apartments on ca. 25 ha, with 5000 inhabitants with parks and green spaces of grass and trees. The existing brownfield area has various buildings, infrastructure and paved areas. The development will incorporate a number of BGI features as well as the grassland and trees: swales and a central pond (more details are given in Hamann et al. (2020).

The B£ST analysis was used to value the BAU case for new BGI for (i) the proposed development; (ii) restoring the natural forest; (iii) the existing brownfield as a baseline. An enhanced BGI design was also considered, but is not used here The analysis assumed a lifetime of 30 years with a discount rate of 3%. Results are given in Hamann et al. (2020) and used here to consider the potential value of restoring the area to forest.

The benefits from the BGI in the proposed development have the greatest financial value for human health, amenity and carbon sequestration. Whereas the brownfield baseline has greater carbon sequestration value and greater biodiversity and ecological value than the development. However, restoring the area to natural forest has the greatest value for car-

bon sequestration and biodiversity and ecology of all three options. As the development site is in a suburban part of Luleå, the value of returning the existing brownfield space to forest would not be as significant as were the space in a more dense inner city neighbourhood; e.g. Zhong et al. (2020), state "…*brownfield greening projects… need to be implemented in the more populated and economically vibrant areas* ." The assumptions for numbers of people benefiting from any amenity increase may therefore be an over-estimate, although where these (new) people have come from dense urban areas with no green spaces, these benefits would be significant.

London stormwater management.

London was one of the first cities to build a sewer network[55]. This network has helped maintain public health and minimised flood risk for almost 200 years. Traditionally such systems were built to take sanitary flows and stormwater from streets and buildings. As a consequence, numerous combined sewer overflows (CSOs) were constructed to discharge excess flows into the River Thames in times of heavy rain. Contemporary sanitation approaches seek to minimise CSO discharges in major European Cities, for which the EU Urban Wastewater Treatment Directive sets standards on what can be discharged. To comply with the Directive, a new £6bn, 25km, 7.2m diameter sewer tunnel is under construction in the bed of the river as part of the London-wide scheme[56].

There are numerous reasons why London has selected to build a new 'supersewer' rather than using BGI as in Philadelphia[57]. In this paper the pros and cons of the alternative options are not considered. This case example considers the potential value of using BGI to manage the CSO spills in London, pre and post-Covid 19. Given the exhortations to 'green London'[58], it would seem a sensible option to use BGI to both manage CSO spills by controlling stormwater locally and also using the stormwater as a resource in the water-stressed area of the South-East of England. As in 'the great sanitation revolution' when the new sewers transformed the entire urban area of London[59], were BGI to be used for this today, this would substantially influence London's urbanism and planning processes for decades or even longer into the future. BGI, in contrast with buried sewers, however, requires land space. In London like other industrialised cities, the sewers run beneath buildings and paved areas, thus occupying only underground space. This leaves the surface free for other building and paving over. Most BGI, however, require valuable surface space, as illustrated in *Figure 02*. Because of this, the assessment of where BGI could be located in London described here, concentrated mainly on already green or brownfield areas, but also considered public building areas, including paved car parks.

Several studies were undertaken of the potential for using BGI to manage the CSOs in London when the options were being developed in the 1990s - 2000s. The technical and economic feasibility of using BGI was evaluated by Ashley et al. (2010) (see also Stovin et al. (2013)) and subsequently used to select the tunnel option on the grounds of the cost and complexity of using BGI[60]. The analysis undertaken in the 2010 feasibility study is used here with B£ST to assess: (i) the financial value of the multiple benefits were BGI to be used under BAU; (ii) the future financial value of using BGI tody to a post-Covid 19 London.

55 Allen, 2008
56 Thomas & Crawford, 2011
57 Ashley et al., 2020; Loftus et al., 2019
58 e.g. Mayor of London, 2020
59 Allen, 2008
60 Loftus et al., 2019

The original assessment was carried out for suitability of retrofit of BGI for three subcatchment areas in the West of London, totalling 1021ha (with 12, 36 & 45% of surface areas being impervious). Overall comprising some 1-2% of the paved surfaces of the total catchment area of London's sewers. The aim was to remove or constrain surface water runoff from the greatest extent of these paved surfaces as possible, by retrofitting green and (temporary) blue storage areas. The catchments were mainly suburban, encompassing several areas of extensive green space, including parks, commons, playing fields and woodlands. *figure 03 — page 56*  The BGI were considered as retrofit across the existing subcatchment areas, mainly in existing green and municipal land spaces and on flat roofs, with rain gardens also being installed in many roads and rainwater barrels to the rear of properties. These were all local BGI controls and further work could have also considered regional controls at a larger scale. The effectiveness of the assumed BGI at reducing CSO spills was determined from modelling as explained in Stovin et al. (2013). Using these subcatchment studies, the results were scaled up across London, and it was determined that in total some 10,300ha of paved surfaces (50% of the total) needed to be disconnected using BGI to achieve 54% CSO volume reductions.

At the time, there were no tools like B£ST available to assess the financial added benefits of using BGI in this way. However, the scaled up direct whole life costs for retrofitting was estimated at some £2.7bn across London (£12.7 per m^3 disconnected surface). These costs did not include either land or disruption costs which were likely to be significant.

As the B£ST valuation was an approximate and first effort, the uncertainty in the assessment is high and the confidence scores were set low accordingly[61]. The results from the B£ST value assessment are shown in *Figure 04*. This is for BAU (the now, with predicted climate and other land use planned change factors), assuming all the benefits accrue immediately, and also for the post-Covid 19 condition in 30-50 years time, including the implications of the other change factors in Table 1. The scenario planning option in B£ST was used to adjust the BAU valuations using the scaling factors in the last column of Table 2.

The greatest potential (BAU) benefits accrue in reducing order to the categories: health, flooding, amenity, and asset performance. In the post-Covid 19 scenario these are still significant benefits, although the benefits of BGI to amenity (property prices) become less proportionately valuable. Overall, the post-Covid 19 benefit value from implementing BGI today, decreases from £2.5bn to £2.1bn, despite the value of the benefits for carbon, groundwater recharge and rainwater harvesting increasing. This scenario is only one view of the potential future and other scenarios should also be considered in order to give proper consideration as to how the value of the BGI proposed in this project could provide benefits over the longer term.

This example has been used to demonstrate the potential added value brought by using BGI retrofitted into a major urban area, and how the financial value of using BGI now will change into the future, dependent on the type of future expected. *figure 04 — page 57* 

61 Ashley et al. 2018a

URBANISM

What does this monetisation of green and other spaces mean for urbanism? The examples above provide compelling evidence for the use and maintenance of GI/NBS in urban areas and the designation and protection of the spaces required for this. New developments for example, should include as much NBS as feasible and the economics, as demonstrated in this paper, can be very persuasive. If the current solution to the CSO pollution problems had not been selected as a buried sewer, it would have provided a major opportunity to re-cast London on the surface using BGI/NBS. A process which is in any case likely to be happening, alongside the moves to open up the waterfrontage to the tidal river, but over a much longer period and in a less coordinated way, as a business opportunity[62]. The valuation shown here demonstrates the very considerable added value were BGI to have been used in London at some £2.5bn, of which only £1bn is for water related benefits, i.e. £1.5bn would accrue to non-water related benefits such as property prices and human health benefits. Even with the potential changes over the next 30 – 50 years due to the factors in Table 1, the proportion of non-water related benefits remains high at more than 50% of the total from using BGI today at some £1.1bn. These benefits accrue both at a very local level, with on the ground neighbourhood changes and in total, coordinated or otherwise, upscaled across the City, create major opportunities for change in how urbanism is approached and in people's experiences thereof, both for the professional deliverers and citizens. Covid 19 has highlighted that the uncertainty that has been much heralded by the climate change prophets really exists[63], and that the time to change the way urbanism functions is right now.

The London example, and that for Kronandalen, demonstrate differences in scale, illustrating that the way in which surface water is handled in urban areas is a major component influencing urbanism, including city form and function. In the cases used here, no other change factors regarding urban water management have been considered, although there are numerous initiatives to decentralise both water supply and sanitation systems, moves that will be synergistic with the use of NBS[64].

Despite the valuations shown earlier in this paper, there are many critics of the monetisation approach to BGI as a means of supporting natural systems, suggesting that nature cannot or should not, be monetised. Also of 'greenwashing' with BGI; i.e. making claims about developments that are supposedly 'restoring nature'. The Oxford-Cambridge Arc is a plan to build one million new homes: "…*could show how development can restore nature, rather than destroy it…. the perfect opportunity to invest in nature, improve people's lives and realise the green recovery*." Apparently this is 'putting nature first' under the banner of sustainable development and being badged as 'nature's arc' by numerous wildlife organisations[65], abetted by professional planners[66]. Similarly, the UK's Institution of Civil Engineers has endorsed an approach supposedly to 'maximise social value'[67], that, in many of the examples presented, simply accepts unsocial developments and attempts to add social value to these, rather than embedding social value into a scheme from the outset[68]. Notwithstanding these concerns, it would appear that the only game in town now is to monetise everything, including nature, in order to get the attention of policy and decision makers. This has major consequences for urbanism.

62 e.g. GLA Economics, 2020
63 e.g. Dudman, 2020
64 e.g. Ashley et al., 2020
65 Monbiot, 2020
66 Beds, Cambs & Northants Wildlife Trust
67 ICE, 2020
68 Carmona, 2019

What then is the way forward for urbanists? Starting with challenging mindsets that are stuck in the status quo[69] and using the alarm call that Covid 19 has brought highlighting the importance of maximising human health benefits, there needs to be extensive reform of professional life, recognising that land use planning is at the heart of urbanism, much as set out by Bibri (2020). This puts planners in the driving seat supported by other built environment professionals and environmentalists[70]. Yes, the neoliberal game needs to be played[71], but urbanists now have the tools to put financial value on nature in towns and cities, ensuring that existing spaces are maintained and new BGI is preferenced over traditional approaches. In many places this should be accompanied by political and institutional reform, with realignments of governance arrangements[72]. However, this is unlikely to happen, so urbanists and supporters will need to find other ways to influence decision makers despite the lack of reform. Social change looks inevitable in post Covid 19 urban areas and there is a need to question the assumption that sustainability is best served by compact urbanism[73], and find new ways of using social innovation, exploiting local initiatives and community needs and the capacities that are emerging, showing very successful changes towards greening in cities like Rotterdam that are not compacting[74].

69 e.g. ICE, 2020
70 e.g. Rogers et al., 2020
71 see Loftus et al. (2019) for how the sewer tunnel in London has been chosen on purely these grounds
72 e.g. Willems et al., 2020
73 Bibri, 2020
74 e.g. Willeme, 2020

CONCLUSIONS

Most of humanity craves stability. Especially in the industrialised world, known lifestyles, security at least for most, mean that threats to this stability are unwelcome. Yet human habitation and urban living continue to change as the world changes and knowledge about this advances. The current challenges are set within the context of a secure neoliberal economic frame, that shows no sign of change in the current Century. The pre-Covid 19 trends to green cities for human health and liveability reasons bring many other benefits, which are beginning to be exploited especially now that a financial value is being put on these, thus fulfilling the neoliberal economic perspective.

The imposition of changes to living, working and communities necessary to cope with Covid 19 (and less urgently it seems climate change) have demonstrated the fragility of contemporary urbanism. Modern cities are not laid out or designed to function in the most effective way to resist the impacts of pandemics or to support ecosystems. Now the need to be physically present in an office or other place of work has been shown to be less important as workers have modified activities to be separated from colleagues. This raises the possibility that urban spaces could depopulate, perhaps becoming less important, with rural or semi-rural living becoming more attractive. Opening up the urban spaces to alternative uses, alongside the reduction in road space that autonomous vehicles will provide, bring major opportunities now for urbanism. The main obstacles to getting it right are the blocking mindsets of many and their aversion to risk, i.e. innovation.

This paper has explored (in some instances speculatively) the implications of financial valuation of blue-green infrastructure (BGI as part of the current vogue for nature-based solutions (NBS) under business-as-usual (BAU) and also for post-Covid 19 urbanism. The paper has shown

how the management of surface water as the main driver in two examples: for a housing development in Luleå Sweden; and for managing sewer overflows in London's Thames Delta, also brings significant financial benefits not directly related to water management. The Kronandalen case in Sweden demonstrated that there was a strong case in a post-Covid 19 city to return a brownfield site to forest rather than building new houses, albeit the latter has potentially more financial value. In London, the wealth of added opportunities and value that BGI would bring both under BAU and in a post-Covid 19 city, and the fit with the other upcoming changes in urban form and living, such as the use of autonomous vehicles, seem to make an overwhelming case for using BGI, as was found in Philadelphia. Ironically, in London a new sewer tunnel is under construction instead, mainly as a playing out of the dominant imperative neoliberal economic pathway and attendant mind blocking mindsets.

Overall it may be that the changes to urbanism that were already in train before the Covid 19 pandemic become accelerated, including urban greening. As urbanists we need to make sure that the new 'normal' is not what it was before, i.e. unsustainable, unattractive and unhealthy urban areas.

Acknowledgements — The work presented draws on aspects of the EU INTERREG IV North Sea Region project BEGIN. https://northsearegion.eu/begin/

Allen, M. (2008). Cleansing the City. Ohio University Press, Ohio 45701. ISBN -13: 978-0-8214-1770-6

Ashley, R. M., Stovin, V., Moore, S., Hurley, L., Lewis, L., & Saul, A. (2010). London Tideway Tunnels Programme Thames Tunnel Needs Report. Potential Source Control and SuDS Applications: Land use and retrofit options. April. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/WW010001/WW010001-001276-8.3_Needs_Report_Appendix_E_Potential_Source_Control_and_SuDS_Application.pdf

Ashley, R. M., Digman, C. J., Horton, B., Gersonius, B., Smith, B., Shaffer, P., & Baylis, A. (2018). Evaluating the longer term benefits of sustainable drainage. Proceedings of the Institution of Civil Engineers Water Management 171 April 2018 Issue WM2 Pages 57–66. Available at: https://doi.org/10.1680/jwama.16.00118. Paper 1600118

Ashley, R. M., Gersonius, B., Digman, C., Horton, B., Smith, B., & Shaffer, P. (2018a). Including uncertainty in valuing blue and green infrastructure for stormwater management. Ecosystems Services 33 (2018) 237–246. S2212-0416(17)30733-7, DOI 10.1016/j.ecoser.2018.08.011

Ashley, R. M., Gersonius B., & Horton B. (2020). Managing flooding: from a problem to an opportunity. Phil. Trans. R. Soc. A 378: 20190214. http://dx.doi.org/10.1098/rsta.2019.0214

Beds, Cambs & Northants Wildlife Trust, Berks, Bucks & Oxon Wildlife Trust, RSPB, & Woodland Trust (2020). Nature's Arc: How the proposed Oxford to Cambridge Arc can help restore nature across central England. https://www.rspb.org.uk/globalassets/images/get-involved/campaigning/oxcam-arc/natures-arc-4-pager-final-low-res.pdf

Bibri, S.E. (2020). Compact Urbanism and the synergic potential of its integration with datadriven smart urbanism : An extensive interdisciplinary literature review. Land Use Policy 97, 104703. https://www.sciencedirect.com/science/article/pii/S0264837719317429?via%3Dihub

Blečić, A., & Cecchini, O. (2020). Antifragile planning. Planning Theory, Vol. 19(2) 172–192. DOI: 10.1177/1473095219873365

Brown, R. R., Keath, N., & Wong, T. H. (2009). Urban water management in cities: historical, current and future regimes. Water Science & Technology, 59(5), 847-855. doi:10.2166/wst.2009.029

Carmona, M. (2019). Place Value: place quality and its impact on health, social, economic and environmental outcomes. J. of Urban Design, 24:1, 1-48. DOI 10.1080/13574809.2018. 1472523

Chini, C.M., Canning, J.F., Schreiber, K.L., Peschel, J. M., & Stillwell, A. S. (2017). The green experiment: cities, green stormwater infrastructure, and sustainability. Sustainability 9, 105. DOI 10.3390/su9010105

CIRIA (2020). B£ST (Benefits Estimation Tool). https://www.susdrain.org/resources/best.html

Colton, D. (2020). The Affordability of Water and Wastewater Service In Twelve U.S. Cities: A Social, Business and Environmental Concern. Fisher, Sheehan & Colton Public Finance and General Economics Belmont, MA, USA

Costanza R., De Groot, R., Sutton, P., Van der Ploeg, S., Anderson, S. J., Kubiszewski, I., ... & Turner, R. K. (2014). Changes in the global value of ecosystem services. Global Environmental Change. 26, 152-158. http://dx.doi.org/10.1016/j.gloenvcha.2014.04.002

Cotella, G., & Bravarone E. V. (2020). Questioning urbanisation models in the face of Covid-19. TeMA Special Issue | Covid-19 vs City-20, 105-118. ISSN 1970-9889, e-ISSN 1970-9870 DOI: 10.6092/1970-9870/6869

Danryd, E. (2018). Autonomous Vehicles. Crit; Washington Iss. 82, (Jan 2018): 46-47

Drury C. (2020). A car-free future? How UK cities are moving towards a pedestrian age. Independent. 26th January. https://www.independent.co.uk/environment/car-free-cities-pedestrianisation-cycling-driverless-vehicles-york-oslo-birmingham-a9299856.html

Dudman K. (2020). If you think Covid-19 is a dress rehearsal, you may be at the wrong play. TORCH - The Oxford Research Centre in the Humanities. 30th April. https://torch.ox.ac.uk/article/if-you-think-covid-19-is-a-dress-rehearsal-you-may-be-at-thewrong-play

EEA (2020). Healthy environment, healthy lives: how the environment influences health and well-being in Europe. © European Environment Agency. Luxembourg: Publications Office of the European Union. ISBN 978-92-9480-212-5/ISSN 1977-8449. doi:10.2800/53670

Elmqvist, T., Andersson, E., Frantzeskaki, N., McPhearson, T., Olsson, P., Gaffney, O., ... & Folke, C. (2019). Sustainability and resilience for transformation in the urban century. Nat Sustain 2, 267–273. https://doi.org/10.1038/s41893-019-0250-1

Emery, M. (1986). Promoting nature in towns and cities: A practical guide. Croom Helm publishing, Beckenham, Kent. ISBN 0-7099-0970-5

Errichiello L., & Demarco D. (2020). From social distancing to virtual connections. TeMA Special Issue | Covid-19 vs City-20, 151-164. ISSN 1970-9889, e-ISSN 1970-9870 DOI: 10.6092/1970-9870/6902

European Investment Bank (2020). Investing in Nature: Financing conservation and nature-based solutions. European Investment Bank, Luxembourg, www.eib.org –NCF_Instrument@eib.org

Fagnant D.J., & Kockelman K.M. (2014). The travel and environmental implications of shared autonomous vehicles, using agent based model scenarios. Transportation Research Part C 40 pp 1-13.

Feng Y., & Tan P.Y. (2017). Imperatives for Greening Cities: A Historical Perspective. In: Tan P., Jim C. (eds). Greening Cities. Advances in 21st Century Human Settlements. Springer, Singapore. https://doi.org/10.1007/978-981-10-4113-6_3

Fenner R., & Digman C.J. (2020) Assessing the benefits of multi-functional urban flood risk management in blue-green cities. Ch.8 in: Thorne C R (Ed.) Blue-Green Cities. ICE publishing, London. ISBN 978-0-7277-6419-5. Thomas Telford Ltd., London

Fistola, R., & Borri, D. (2020). Virucity rethinking the urban system. Tema. Journal of Land Use, Mobility and Environment, 179-187. http://dx.doi.org/10.6092/1970-9870/6971

Geels F. W. (2006). The hygienic transition from cesspools to sewer systems (1840–1930): The dynamics of regime transformation. Research Policy 35 (2006) 1069–1082

Ginn, W.J. (2020). Valuing Nature. Island Press, Washington DC 20036. ISBN 978-1-6428-3091-0

GLA Economics (2020). Industrial Strategy. February. Greater London Authority.

Hamann, F., Tobias Blecken, G., Ashley, R.M., & Viklander, M. (2020). Valuing the Multiple Benefits of Blue-Green Infrastructure for a Swedish Case Study: Contrasting the Economic Assessment Tools B£ST and TEEB. ASCE J. Sustainable Water Built Environ. 6(4): 05020003. DOI: 10.1061/JSWBAY.0000919

Heathcote, E. (2016). Construction is turning London into a city of holes. Financial Times, 21. April 2016.

Helm, D. (2020). The environmental impacts of the Coronavirus. Env & Res. Economics. 76:21-38. https://doi.org/10.1007/s10640-020-00426-z

Hobbie, S.E., & Grimm N.B. (2020). Nature-based approaches to managing climate change impacts in cities. Phil. Trans. R. Soc. B 375:20190124. http://dx.doi.org/10.1098/rstb.2019.0124

ICE (2020). Maximising Social Value from Infrastructure Projects. V1.1 June. Useful Projects, London. www.usefulprojects.co.uk

Iravani H., & Rao V. (2020). The effects of new urbanism on public health. J. of Urban Design. Vol. 25, No.2, 218-235. DOI: 10.1080/13574809.2018.1554997

Karaman, O., Sawyer, L., Schmid, C., & Wong, K. P. (2020). Plot by Plot: Plotting Urbanism as an Ordinary Process of Urbanisation. Antipode Vol. 52 No. 4 2020 ISSN 0066-4812, pp. 1122–1151 doi: 10.1111/anti.12626

Kron, W., Löw, P., & Kundzewicz, Z. W. (2019). Changes in risk of extreme weather events in Europe. Environmental Science & Policy Volume 100, October 2019, Pages 74-83. https://doi.org/10.1016/j.envsci.2019.06.007

Lai, S., Leone, F., & Zoppi, C. (2020). Covid-19 and spatial planning. TeMA Special Issue | Covid-19 vs City-20, 231-246. ISSN 1970-9889, e-ISSN 1970-9870. DOI: 10.6092/1970-9870/6846

Laybourn-Langton, L., Emden, J., & Hill, T. (2020). We Are Not Ready – Policymaking In The Age Of Environmental Breakdown. IPPR London. https://www.ippr.org/files/2020-06/we-are-not-ready-june20.pdf

Loftus, A., & March, H. (2019). Integration for whom? Financialisation and the Thames tidewaytunnel. Urban Stud. 56, 2280–2296. doi:10.1177/0042098017736713

Maier, H.R., Guillaume, J.H.A., van Delden, H., Riddell, G. A., Haasnoot, M., & Kwakkel, J. H. (2016). An uncertain future, deep uncertainty, scenarios, robustness and adaptation: how do they fit together? Environ. Modell. Softw. 81, 154–164. https://

doi.org/10.1016/j.envsoft.2016.03.014
Mayor of London (2020). National Park City. https://www.london.gov.uk/what-we-do/environment/parks-green-spaces-and-biodiversity/london-national-park-city
Meya, J.N. (2020). Environmental Inequality and Economic Valuation. Environmental and Resource Economics. https://doi.org/10.1007/s10640-020-00423-2
Monbiot, G. (2020). How did wildlife groups start collaborating in the destruction of nature? 24th June. https://www.theguardian.com/commentisfree/2020jun/24how-did-wildlife-groups-start-collaborating-in-the-destruction-of-nature-
Morgan, M., & Fenner, R. (2017). Spatial evaluation of the multiple benefits of sustainable drainage systems. Proc. Inst. Civil Engineers. Water Management 172 (1), 39-52
Muroff, M., & Shipp, A. (2019). Why green stormwater infrastructure is smart policy and smart business. Philadelphia Business Journal. May 24. https://www.bizjournals.com/philadelphia/news/2019/05/24/green-stormwater-infrastructure-philadelphia.html
Osborne, H. (2020). Renters fleeing inner London in race for space, data suggests. Guardian. Tuesday 15 September
Pearsall, H., & Eller, J.K. (2020). Locating the green space paradox: A study of gentrification and public green space accessibility in Philadelphia, Pennsylvania. Landscape and Urban Planning 195 103708. https://doi.org/10.1016/j.landurbplan.2019.103708
Pisano, C. (2020). Strategies for Post-COVID Cities: An Insight to Paris En Commun and Milano 2020. Sustainability, 2020, 12, 5883; doi:10.3390/su12155883.
Polsky, M. (2019). Leverage points meets sustainable transformation: Speeding up sustainability progress and 101 mindset barriers to it. OIDA International Journal of Sustainable Development, Ontario International Development Agency, Canada. ISSN 1923-6662 (online) www.oidaijsd.com http://www.ssrn.com/link/OIDA-Intl-Journal-Sustainable-Dev.html
Rogers, B.C., Bertram, N., Gersonius, B., Gunn, A., Löwe, R., Murphy, C., ... & Arnbjerg-Nielsen, K. (2020). An interdisciplinary and catchment approach to enhancing urban flood resilience: a Melbourne case. Phil. Trans. R. Soc. A 378, 20190201. doi:10.1098/rsta.2019.0201
Russo, A.,& Cirella, G. T. (2019). Edible urbanism 5.0. Palgrave Communications, 5:163. https://doi.org/10.1057/s41599-019-0377-8 www.nature.com/palcomms
SBN (2016). The economic impact of green city, clean waters: the first five years. Sustainable business network of Philadelphia. https://gsipartners.sbnphiladelphia.org/wp-content/uploads/2014/07/Local-Economic-Impact-Report_First-Five-Years-GCCW_full-downloadable-web2.pdf
Sochacka, B., Kenway, S., & Renouf M. (2020). Water and liveability – beyond the obvious. OzWater conference proceedings. 20th May. https://watersensitivecities.org.au/content/water-and-liveability-beyond-the-obvious/
Stovin, V.R., Moore S.L., Wall, M., & Ashley, R.M. (2013). The potential to retrofit sustainable drainage systems to address combined sewer overflow discharges in the Thames Tideway catchment. Water and Environment Journal 27, 216–228 © 2012 CIWEM. Print ISSN 1747-6585
Sukhdev, P., Wittmer, H., Schröter-Schlaack, C., Nesshöver, C., Bishop, J., Brink, P. T., ... & Simmons, B. (2010). The economics of ecosystems and biodiversity: mainstreaming the economics of nature: a synthesis of the approach, conclusions and recommendations of TEEB. Valletta, Malta: Progress Press. http://www.teebweb.org/our-publications/teeb-study-reports/
Thomas, G.B., & Crawford, D. (2011). London Tideway Tunnels: tackling London's Victorian legacy of combined sewer overflows. Water Sci. Tech. 63.1
Thurston, H.W. (ed) (2012). Economic incentives for stormwater control. CRC Press ISBN 978-1-4398-4560-8
UK Government (2020). A Systems Approach To Delivering Net Zero: Recommendations From The Prime Minister's Council For Science And Technology. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910446/cst-net-zero-report-30-january-2020.pdf
Vivid Economics (2017). 'Natural capital accounts for public green space in London'. Report for the Greater London Authority, National Trust and Heritage Lottery Fund
Watts, N., Adger, W. N., Agnolucci, P., Blackstock, J., Byass, P., Cai, W., ... & Cox, P. M. (2015). Health and climate change: policy responses to protect public health. Lancet 386: 1861-914. http://dx.doi.org/10.1016/S1040-6736(15)60854-6.
Willeme, A. (2020). Rotterdam drops €233 million on green spaces — and they look INCREDIBLE. Dutch review. June 18. https://dutchreview.com/cities/rotterdam-drops-233-million-on-green-spaces-and-they-look-incredible/
Willems, J., Molenveld, A., Voorberg, W., & Brinkman, G. (2020). Diverging Ambitions and Instruments for Citizen Participation across Different Stages in Green Infrastructure Projects. Urban Planning (ISSN: 2183–7635) 2020, Volume 5, Issue 1, Pages 22–32. DOI: 10.17645/up.v5i1.2613
Yeoman, R. (2019). The Meaningful City: Toward a Theory of Public Meaningfulness, City Institutions, and Civic Work. The Oxford Handbook of meaningful work. DOI: 10.1093/rdhb/9780198788232.013.28
Zhong, Q., Zhang, L., Zhu, Y., Konijnendijk van den Bosch, C., Han, J., Zhang, G., & Li, Y. (2020). A conceptual framework for ex ante valuation of ecosystem services of brownfield greening from a systematic perspective. Ecosystem Health and Sustainability, 6:1, 1743206, DOI: 1080/20964129.2020.1743206

01

02

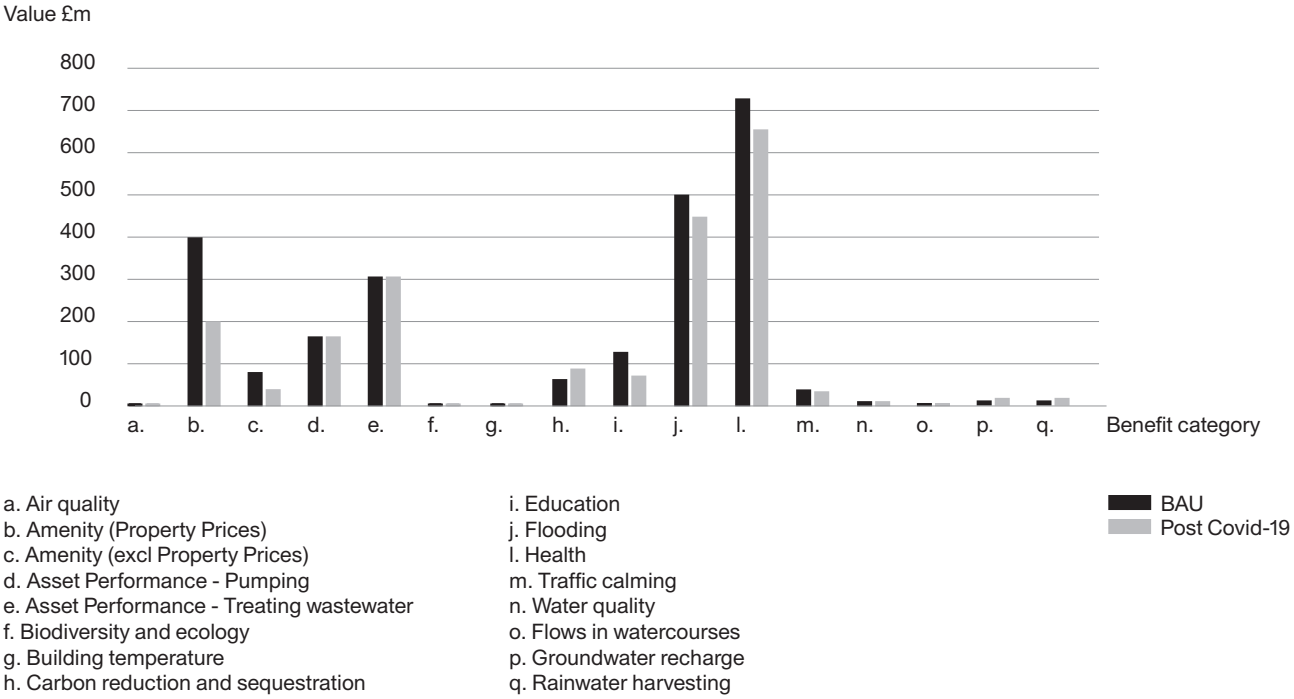
01 From existing to future urban spaces – diagrammatic illustration of current change trends

02 Greening Philadelphia - Berks and Sedgley project, in the Strawberry Mansion neighbourhood. Includes rain garden, subsurface trench, tree trenches and planters. (Photo: by permission of Philadelphia Water Department)

03

03

03 Examples of the sub-catchment spaces considered for retrofitting BGI in London (photographs: the author)



04

04 4 B£ST valuation of retrofit BGI in London subcatchments. BAU is the potential (total) value and Post Covid 19 applies to future urbanism and includes other change factors from Table 1.

Dialogues

On sustainable delta development

Delta Urbanism's main ingredient is dialogue. The integration of concepts, ideas, language and measures can only be done through conscious exchange in continuous dialogue. This is not taken lightly, just exchange is not good sufficient, a solid dialogue is conscious and supported by methods that orchestrate steps, information and design.

Therefore a section that presents the dialogue between two professionals is essential to this journal. The exchange is directed through writing and editing, taking time to think responses through and to position them clearly.

This issue represents the dialogue between Bas Jonkman and Henk Ovink who continue the dialogue that they started as keynote speakers at the conference of Delta Urbanism in Times of Climate Crisis in March 2020.

Sustainable coastal adaptation is possible
S. N. (Bas) Jonkman

Around the world, many low lying coastal areas are at significant risk from floods and other hazards. Rising sea levels further necessitate the development, preparation and implementation of coastal adaptation strategies. Coastal adaptation will be costly, drastic and challenging. But is it possible and affordable, particularly for low-lying countries? In this article, it is argued that sustainable coastal adaptation *is* possible, when coastal protection strategies are streamlined with other development ambitions and cleaner construction-methods are found. This will require multidisciplinary collaboration and governmental commitment and investment.

In the Netherlands, 26% of the country is below mean sea level, and 60% is prone to flooding. Most of the che current defence system can already accommodate up to one meter of sea level rise. This should be sufficient until the second half of this century – even in scenarios with higher sea level rise rates. Various studies (Stijnen et al., 2014; Haasnoot et al., 2019; ENW, 2019; Wilmink et al., 2019) have investigated if and where the system would need to be adapted for varying levels of sea level rise – also see *figure 1* for an overview.

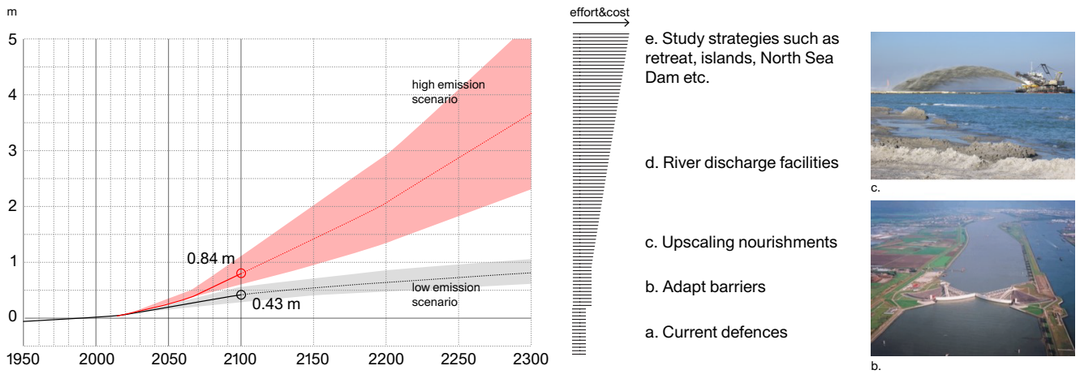


figure 1 Sea level rise projects for the Netherlands (left) and adaptation efforts required (based on ENW, 2019; left figure adapted from NRC 250919/RL, Source: IPCC)

Approaching about 1 meter sea level rise, the first large-scale adaptations would be needed in the Southwestern part of the country, more specifically for the Maeslant and Eastern Scheldt storm surge barriers and their surrounding regions.

Options include removal, upgrading of barriers and the implementation of new open or closed barrier systems. For example, an open Eastern Scheldt estuary with dikes raised around the estuary, or a dam with a shipping lock near Rotterdam. The dam with lock-combination intervention would imply massive changes to logistic and economic functions in the region, and the way water is managed in urban areas, such as Rotterdam and Dordrecht.

For higher values of sea level rise, the nourishment on sandy parts of the coast would have to be scaled up drastically. This seems possible given the vast sand supply that is available in the North Sea. For multiple meters of sea level rise, natural discharging of the main rivers (Rhine, Meuse) to the North Sea becomes problematic, and solutions such as mega-pump stations would have to developed.

Overall, adaptation for two to three meters of sea level rise is expected to come at a high cost – but it should be *technically feasible* (Stijnen et al., 2014, ENW, 2019). Moreover, as such levels of sea level rise are only projected in the 22nd or 23rd century, several decades or more will be available to fund and implement these solutions. In the past, the Dutch have already upgraded their system in a matter of decades. After the 1953 storm surge disaster – which killed more than 1800 people – a new system of storm surge barriers has been constructed, and the sea defences in the South West have nearly doubled in height and footprint since then.

Are these levels of adaptation economically feasible? Current expenditures for flood management in the Netherlands are about one billion Euro per year. In case of accelerated sea level rise, this amount could double (Stijnen et al., 2014). This is, of course, a major investment. But it is still considered affordable compared to the current gross domestic product, which was around800 billion Euros in 2019 and is expected to grow in the longer term future.

Higher values of sea level rise (3 to 5 meters) are projected after the year 2200 in the highest scenarios. Studies are ongoing to develop national strategies (retreat, defend or seaward expansion), and to give more insight in their costs, implications, and possible links with other transitions (Haasnoot et al., 2019). At a higher spatial scale, an international solution is considered in the form of the

Water as catalyst for sustainable development
Henk Ovink

With the world at risk, investing in water inclusively and holistic is our best bet for a sustainable and resilient future. Disasters are layered and interdependent, increasing in their impact not only in terms of damage but also exacerbating our future vulnerability. Practices from the past are replicated massively only to make us more vulnerable tomorrow. In the light of the need for a better - more inclusive, integrated and sustainable – future, the world came together in 2015. Five years ago, we agreed on a comprehensive set of global goals: the Sendai Framework for Disaster Risk Reduction in March, the Addis Ababa Action Agenda on Financing for Development in July, the Sustainable Development Goals in September, the Paris Climate Agreement in December and the New Urban Agenda in October of the next year (2016). A suit of commitments that together form the 2030 Agenda for Sustainable Development. A midterm-plan for the planet and society to overcome our current challenges together and prepare ourselves for a challenging future. And its through leveraging water's values and capacities that we can achieve these goals and use the next years as springboard for a true sustainable future for all.

Water is linked to all these global commitments in many ways, across the full 2030 Agenda. From climate mitigation and adaptation in the Paris Climate Agreement, where major climate adaptation challenges include water security issues with respect to increases in water scarcity, drought and flood risk, and rising water temperatures affecting water quality and biodiversity. With its link to human health and well-being, clean water and sanitation, food production, sustainable cities and communities, and the quality of ecosystems, water is directly and indirectly linked to many - not to say all - of the Sustainable Development Goals (SDGs, *figure 1*). Improving protection against water-related disasters is also covered under the Sendai Framework for Disaster Risk Reduction. The New Urban Agenda from 2016 specifically concerns the sustainable development of cities and urbanizing deltas (Ligtvoet et al., 2018).

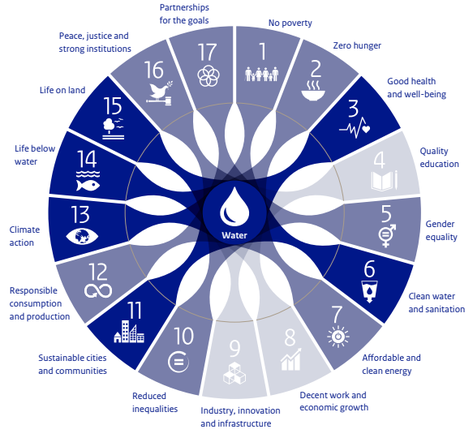


figure 1 Water and its interdependencies across all SDGs, from "The Geography of Future Water Challenges" by the Netherlands Environmental Assessment Agency (PBL, 2018)

And we see our vulnerability exposed with every disasters and its links to water security. From floods to droughts to migration, and now with the current COVID-19 pandemic. In places already plagued by war, climate change and poverty, Covid-19 is the breaking point. The pandemic not only exposes how complex and interconnected our challenges are; it also reveals transcending solutions. Investing in water, sanitation, and hygiene (WASH) is the first line of defence and the first step towards a sustainable recovery. Never has the sixth UN Sustainable Development Goal (SDG) been more vital for saving and protecting lives. But to deliver on our promise of the SDGs, we need collective commitment, continuity in our programs and consistency of our ambitions.

Water comes to mind first and foremost in times of climate suffering: too much and too little increasingly linked to climate change impact. Wet places get wetter, dry places drier. Our cities flood through cloudbursts and storms, or dry out in the mix of unsustainable water use, depletion of our aquifers and infrastructure failures. But it seems we learn by default and disasters only. While we all know preparedness pays by preventing losses and reducing impacts costs go down while prevention measures also helps us better prepare for future uncertainties. Investing in preparedness therefor safes lives, costs and adds values: from better health, more security, improved ecology, a decreasing gender gap and strengthened youth capacity - the benefits are numerous. Why then shy away from sustainable investments that increase resiliency and open up our portfolios for more and a much wider range of opportunities?

The 2020 WEF Risk report lists water again in the top (WEF 2020). Linking it to everything risky: the economy, geo-politics, the environment, climate change and more. The report reiterates an over and over played painful song: Water scarcity will increase already affecting a quarter of the world's population. Crop yields will likely drop in many regions, undermining the ability to double food production by 2050 to meet rising demand. How we grow food, produce energy, dispose of waste and consume resources is destroying nature's delicate balance of clean air, water and life that all species—including humans—depend on for survival. And climate change not only dries out our lands and waters, floods our coasts destroying our economies, it is also "the greatest threat to global health in the 21st century" (WHO). With extreme weather conditions putting populations around the world at risk of food and water insecurity. Today's children face a future of increasingly serious climate-related hazards: less nutritious crops, air pollution exacerbated by burning fossil

Northern Europe Enclosure Dam (NEED). The solution concerns a nearly 500km long dam through the North Sea, to protect the entire coast of Northwestern Europe against storm surge and sea level rise (Groeskamp & Kjellson, 2019).

In the Netherlands, adaptation to several meters of sea level rise seems technically and economically feasible. But it remains a major task. The situation is different and much more urgent in other parts of the world. Low-lying small island states (e.g. Kiribati, Tuvalu, Maldives) and parts of Bangladesh and Indonesia, need coastal adaptation on the very short term – and in more challenging physical, organizational and economic conditions. Some of the building blocks of the Dutch approach, such as feasibility studies on adaptation alternatives and systematic governance and funding arrangements, could still be of merit here.

TOWARDS SUSTAINABLE COASTAL ADAPTATION

From a civil engineering perspective, the concepts and building blocks to protect the coastline seem largely available. The toolbox contains solutions ranging from 'hard' (e.g. dikes, sea walls, barriers, dams) to 'nature-based' or 'soft' interventions such as wetlands, nourishments and mangroves or other forms of vegetation. Moreover, mitigating measures such as elevating, zoning or flood proofing of urban areas, or crisis management, may limit impacts of coastal disasters. A question remains how successful and sustainable coastal adaptation can be realized. After all, a *multi-disciplinary* approach is needed to shape coastal adaptation. Ideally, the design and development of water infrastructure should be intertwined with long term urban and development strategies. Given the long life times of 50 to 100 years it should also be streamlined with other major transitions, for example for energy systems. This requires involvement of other kinds of expertise then hydraulic engineering only.

It has been argued that such a multi-disciplinary approach towards delta design would involve urban design and planning, hydraulic engineering, environmental and policy sciences (Meyer & Nijhuis, 2013). These could jointly deliver an *integrated design* of future coastal cities and landscapes. The integrated designs also need to be adaptive to account for climatic, economic and social uncertainties.

This leads to intriguing questions for the case of the Netherlands. For the example of the Rotterdam area of the Netherlands, not only a coastal protection strategy has to be developed, but also a transition strategy of the current "fossil energy" port towards a green port (focussing on sustainable means of energy), as well as an urban development strategy. These developments are strongly interdependent and need to be synchronized. This hinges to a large degree on the way the current Maeslant barrier system will be adapted. This, after all, will determine whether there will be open access between the city and the port; and if there will be a controlled water level (like in Amsterdam), or tide (current situation) in the city.

Perhaps the most challenging aspect is to develop sustainable forms of coastal adaptation, particularly in tougher economic circumstances. Initially, it might seem attractive to expand and extrapolate existing forms of coastal management. Yet, the existing solutions could reach their technical limits, and/or come into conflict with other functions. For example, more and more space will be needed for upgrading coastal defence (i.e. higher and wider coastal dikes or dunes) which will lead to planning problems in densely populated coastal zones. It is therefore a challenge for hydraulic engineers, planners and other disciplines to develop sustainable strategies, that enhance ecosystem services and society and that are adaptable to changing conditions. In the Netherlands and other nations, coastal and delta management are already moving towards more nature-based forms of management (De Vriend et al., 2015). At the same time, hard engineered structures are often still required to protect urbanized areas against the high impacts of storm surge.

Coastal protection-projects have a major carbon footprint and environmental impact. It is therefore crucial that cleaner approaches for construction, such as the use of electric equipment and vessels, and other solutions that minimize adverse impact, or preferably enhance ecosystems, are developed. It is particularly challenging to develop and invest in sustainable solutions in times of economic crisis (like the current pandemic-induced one). Government investments and tenders could slow down, and the market situation leaves less room for companies to invest in sustainable innovations and construction technologies. Here lies a particular responsibility with the funders of the coastal adaptation projects, most often governments. Speeding up investments in coastal adaptation, fastening planning and permitting, and putting more value on sustainable solutions will support the economy and enhance coastal adaptation on the short and long term.

The past has shown that coastal communities are able to adapt rapidly and drastically, but so far mostly after disasters. A massive hurricane protection system was built around New Orleans within 5 years after hurricane Katrina. The Dutch delta works were built after the 1953 storm surge. However, there are hopeful signs that fewer disasters will be needed for future adaptation. The Dutch have adopted a Delta Fund and Delta program, that safeguards funding and planning efforts for the coming decades. And major coastal adaptation projects are ongoing in other parts of the world, for example in Bangladesh. Also, the global response to the pandemic has demonstrated that large-scale action and investments are possible when the urgency is felt. A next major global challenge is develop sustainable approaches for coastal adaptation pro-actively.

RESPONSE BY HENK OVINK

Professor Jonkman rightly states that around the world, in our deltas and coastal zones at risk, investing in coastal adaptation demands a multi-pronged approach. Investing in our low lying deltas only helps us prepare if we both mitigate climate change with reducing our carbon footprint and offset carbon emissions, while preparing with adaptation and resilience-measures the protection of our coasts and low lying deltas. Professor Jonkman rightly argues that while costly and challenging, investing in our coasts in a comprehensive and inclusive way not only helps to reduce risks, this will also add values across our societal needs. This integrated and inclusive approach matches the

fuels, rising average temperatures and other weather-related disruptions to livelihoods.

The climate crisis is a water crisis. Nine in ten natural disasters are water-related. Between 1995 and 2015, wind and water caused 1,700 billion dollars' worth of damage worldwide, according to UN estimates (UNESCO, UN-Water, 2020). Without water, no energy and no food. Too much water and increasing "extremes" go hand in hand with far too little water; periods of drought align with flows of refugees and conflicts. While we are depleting our natural water supplies at a ruinous rate, sea level rise is jeopardizing our cities and deltas. And without water, women and children often have to walk the wells. With water, these women can carry their communities towards more prosperity, while their kids go to school and progress even further.

So, the choice between prevention and repair is false. Both are essential. We need to start at the source: to reduce greenhouse gases, and make efficient and careful use of our planet and all its resources. Yet at the same time, we need to prepare boldly, comprehensibly and inclusively for tomorrow's extremes. Our man-made systems are not fit for the future. Our cities are built in hard structures. No capacity to hold the rain, no calamity-storage, parks or green roofs. No sewage systems that can hold these massive events. All over the world, our cities and communities face these shocks and stresses. And everywhere, the impact reveals our vulnerability. We have wrecked our natural systems too. Our rivers are channeled up, urbanized or even covered by infrastructure and buildings. While these natural systems used to meander, shrink and grow depending on the flows, they are now stuck in man-made barriers. Barriers again designed and engineered according to outdated standards. And our communities are fragile, vulnerable. Poor people live in poor places all over the world. The vulnerable are hit hardest, while it is exactly the vulnerable who need to invest more and longer to recover.

Cities and deltas are the global hotspots; collective places, collaborative places where everything and everyone comes together, and where we can tackle our challenges comprehensively, inclusively and sustainably. We know that everything is connected: the economic, social, environmental and cultural. Only through a comprehensive approach that connects the dots can we mitigate the risks and adapt for the future. This is exactly what we need to do – connect the dots. And the opportunity to connect the dots is best in our cities and deltas, where we can make the biggest difference. Beware of simplifying this approach. It is very complex and there are no silver bullets to solve these wicked issues. This very complexity, however, is our best opportunity for lasting change. The understanding and exploitation of this complexity is our way forward. We should embrace it for the amazing thing that it is!

The answer to this complexity lies not in single focused solutions - stupid infrastructure - coming form our vested interests and outdated agenda's. Stupid infrastructure pays off, but only on the very short term and only from a financial-economic perspective. It is devastating for climate mitigation and resilience. And we lose out as people and planet, with disastrous impacts on marginalized communities and our biodiversity system, wrecking our food security and economy on the longer run. When will we learn to do better? To mitigate and adapt, to prepare before response and invest everything we have in a sustainable future, leaving no one behind? We have no choice but lessons learned are costly. Yet we have every opportunity to change course now.

Changing course with water as the leverage for sustainable development and climate action, tackling social, economic, cultural and ecological challenges. The availability of clean drinking water safeguards health, education and development, equal opportunities and inclusive sustainable growth. Preserving our ecosystems and natural resources ensures the resilience of our planet and society. By taking a preventive approach on our coasts and in our deltas and cities (in both drylands and wetlands), we can avert the most serious problems and prepare ourselves and our world for a sustainable future that is strong and resilient. Water and water narratives can unite people around the world – politicians and scientists, city dwellers and country dwellers.

With this ambition and perspective we started Water as Leverage for Resilient Cities Asia (World Water Atlas, n.d.), which focuses on this inclusive, collaborative and comprehensive approach to arrive at really transformative climate adaptation projects. Interventions that make a difference and can lift up a community, a city, region, after which we can replicate and scale up for maximum impact. We have to come up with new solutions to tackle our future challenges, since the solutions of the past will make the world a worse place tomorrow. By being proactive, we can understand that future and can build resiliently. We know that the current evaluation standards of our financial partners are not fit for that future. Our policies are based on the understanding of yesterday and not on the understanding of tomorrow. Innovation also involves the task of helping to change our policies and practices, and helping our partners to bypass the system in such a way as to create a free place.

And for that we need a new approach; one that is rigorously inclusive, innovative and comprehensive with everything and everyone working together from beginning to end. A mechanism through which future understanding becomes an inspiration and drives innovation forward, and which includes everyone in the process; bankers and investors are as much a part of this as policymakers and politicians, as community leaders, NGOs, academics and the businesses that develop these solutions. Because with a better collective understanding of the future we can gain a better idea of how to fund innovations arising from that understanding. This is the millions we need to invest in the process to secure the billions for the projects that will really make a difference, and really prepare our society and planet for our challenging future.

There is no time to waste if we want to achieve our climate and sustainable development goals and thus safeguard our planet and our future. For this, we need big and small successes. Together we must take a step forward and invest in water capacity, management, and infrastructure – blue, green, and grey. It is time to invest in integrated,

global goals of the 2030 Agenda, and therefor investing in "sustainable coastal adaptation" is not only possible but also a pathway for reaching our global commitments together.

REFERENCES

De Vriend, H.J., Van Koningsveld, M., Aarninkhof, S.G.J., De Vries, M.B., & Baptist, M.J. (2015). Sustainable hydraulic engineering through building with nature. Journal of Hydro-environment Research, Volume 9, Issue 2, June 2015, Pages 159-171

ENW (2019). Houdbaarheid Nederlandse waterveiligheidsstrategieën bij versnelde zeespiegelstijging. Brief nummer 19-08 21 november 2019. Report. https://www.enwinfo.nl/index.php/9-nieuws/125-advies-versnelde-zeespiegelstijging

Haasnoot, M., Diermanse, F., Kwadijk, J., De Winter, R., & Winter, G. (2019). Strategieën voor adaptatie aan hoge en versnelde zeespiegelstijging – een verkenning. http://publications.deltares.nl/11203724_004.pdf

Groeskamp, S., & Kjellson, J. (2019) NEED: The Northern European Enclosure Dam for if Climate Change Mitigation Fails. Bull. Amer. Meteor. Soc. (2020) 101 (7): E1174–E1189. https://doi.org/10.1175/BAMS-D-19-0145.1

Meyer, H., & Nijhuis, S. (2013). Delta urbanism: planning and design in urbanized deltas – comparing the Dutch delta with the Mississippi River delta. Journal of Urbanism: International Research on Placemaking and Urban Sustainability, Volume 6, 2013 - Issue 2, p160-191. https://www.tandfonline.com/doi/abs/10.1080/17549175.2013.820210

Stijnen, J.W., Kanning, W., Kok, M., & Jonkman, S.N. (2014). Sustainability of the Dutch polder approach. Journal of Flood Risk Management. Vol 7 Issue 1, pages 3–15, March 2014

Wilmink, R., Strijker, B., Kok, M., Jonkman, S.N., & Aarninkhof S.G.J. (2019). Impact zeespiegelstijging op hoogwaterveiligheid, Expert judgement over de houdbaarheid van de voorkeursstrategieën uit het Nederlandse Deltaprogramma bij versnelde zeespiegelstijging. ENW Rapport november 2019

inclusive, and sustainable water programs and projects. Doing so pays off, according to the UN, every US$ 1 invested in safe drinking water in urban areas yields more than US$ 3 in saved medical costs and added productivity. For every US$ 1 invested in basic sanitation, society makes US$ 2.50 back. In rural areas, US$ 7 is gained or saved for every US$ 1 invested in clean drinking water.

So far, we have failed to seize this opportunity. While we have great and inspiring examples, we lack a steady flow of sustainable investments. We continue to invest in infrastructural projects from the past, taken from the shelves, to fill economic stimulus packages. Focused on jobs, jobs, jobs for fast economic recovery, these projects offer no added value for integration, inclusion, or sustainability. Our promises compete with our outdated infrastructure investments. Our commitment is challenged by our vested interests in past mechanisms. The full 2030 Agenda for Sustainable Development with all 17 SDGs should lead the way for recovery, and really prepare us for the challenging future ahead. We need to accelerate and expand a robust pipeline of investment opportunities across the 2030 Agenda. We must practice what we preach. Investing in water across the agenda is the added value enabler we so urgently need. If we continue replicating the past, we'll end up more vulnerable, more unequal and more fragile than before. So, let's build a robust blue and green pipeline of sustainable and transformative investment opportunities now and start to deliver on our promise!

RESPONSE BY BAS JONKMAN

The contribution by Henk Ovink sketches the bigger picture and points the importance and water and climate related challenges in global sustainable development. He rightfully points out the importance of adapting delta cities by means of sustainable and inclusive interventions that have a long term horizon. I observe that a lot of the infrastructure construction and planning that takes place in the field at the moment does not yet account for the broader set of goals that Ovink points out – or using his words can be characterized as "stupid infrastructure". It is a task for engineers, planners and policy makers to close the gap between current construction practices and longer term goals. In this respect there is a key role for the initiators of infrastructure projects (most often governments) to include long term sustainability aspects in the planning of projects as well as in tender processes.

REFERENCES

PBL (2018). The geography of future water challenges. PBL infographics report. Authors: Ligtvoet, W., Bouwman, A., Knoop, J., De Bruin, S., Nabielek, K., Huitzing, H., Janse, J., Van Minne, J., Gernaat, D., Van Puijenbroek, P., de Ruiter, J., & Visser, H.; The Hague: Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency). pbl.nl/future-water-challenges

WEF (2020). The Global Risks Report 2020 15th Edition, World Economic Forum. Geneva, Switzerland. http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf

UNESCO, UN-Water (2020). United Nations World Water Development Report 2020: Water and Climate Change, Paris, UNESCO. [Specific reference to EM-DAT, 2019 and CRED/UNISDR, 2015]. https://www.unwater.org/publications/world-water-development-report-2020/

Worldwateratlas (n.d.). Water as Leverage. https://www.worldwateratlas.org/methodologies/water-as-leverage

Projects

On Atmosphere, Water and Soil

Filippo Lafleur
Isabel Recubenis
Sanchis
Taneha Kuzniecow
Bacchin

The present investigation portrays an experimental line of design and relational thinking aimed at establishing critical design premises in relation with the present state of change and crisis (Goddard et al., 2015 and Maxmen 2018).

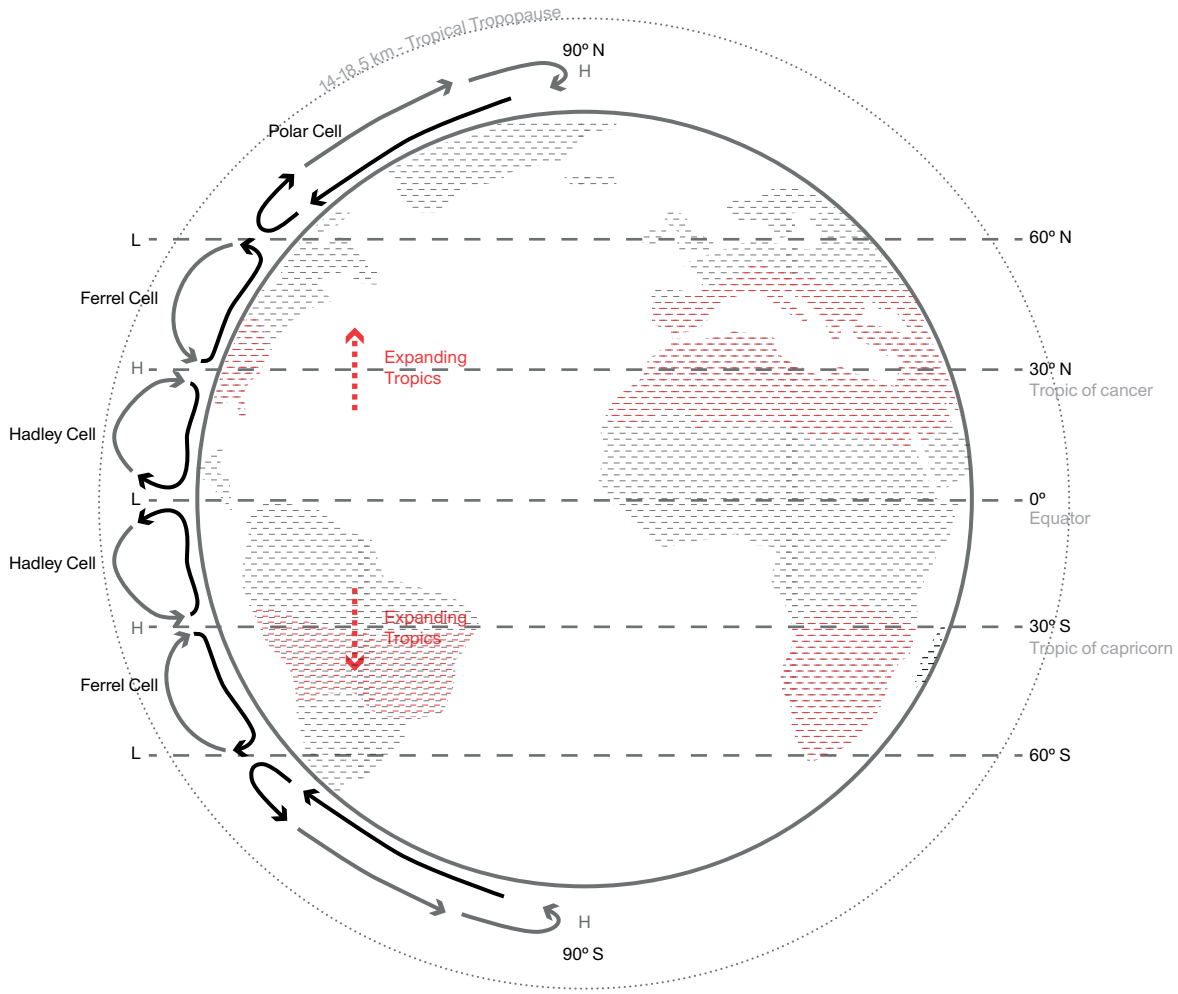
The description of abiotic and biotic shifts within the different realms -atmosphere, water and soil- inform the making of the urban / territorial project so it can contribute to the operationalisation and management of the new conditions of life:

Atmosphere talks about the importance of reading the new biophysical conditions of life through the establishment of a land use system of performances for carbon drawdown.

Water shows the regeneration of ecosystems at watershed level through vegetation density strategies -such as aforestation- to reverse desertification and enhance the water cycle via the Biotic Pump (Makarieva & Gorshkov, 2007).

Both *Water* and *Atmosphere* describe shifting conditions that land on *Soil*, the interface allowing for the interaction of systems, where abiotic conditions are translated and de-codified into biotic conditions. Therefore, Soil identifies the ground (surface-subsurface continuum) as the element of design, the sustaining infrastructure of all living systems, and proposes the transition from current mono-functional land use types to regenerative systems through the inclusion of vegetation diversity and intensity.

The design of the territory of the *new modernity*, as an inter - multi - disciplinary process, must comprehend and project across the whole gradient of urbanisation with the goal to regenerate urban landscapes, that is to say: to regulate atmospheric conditions, manage water patterns, sustain soil health and reconnect stronger culture and nature relations.



CHANGES AT ATMOSPHERIC LEVEL

The current climate crisis coming from the increasing warmth of the planet is technically characterised by an unprecedented amount of carbon in the air (Buis, 2020). This process is due to a particular land use change -from vegetated land cover to built up land cover-, through which carbon is being lost from the ground to the atmosphere more quickly over time (Wu et al., 2020).

The Hadley cell -a large-scale atmospheric convection cell in which warm air rises at the equator and sinks at medium latitudes in both hemispheres- defines tropical climate regions and is one of the major and global engines moving air around the planet. With the rapid increasing warmth of the planet and melting of ice, an increasing volume of water bodies is however shifting evaporation rates and patterns, changing the global moisture circulation patterns in a process coined as the Expansion of Hadley Cells (Hu et al., 2018).

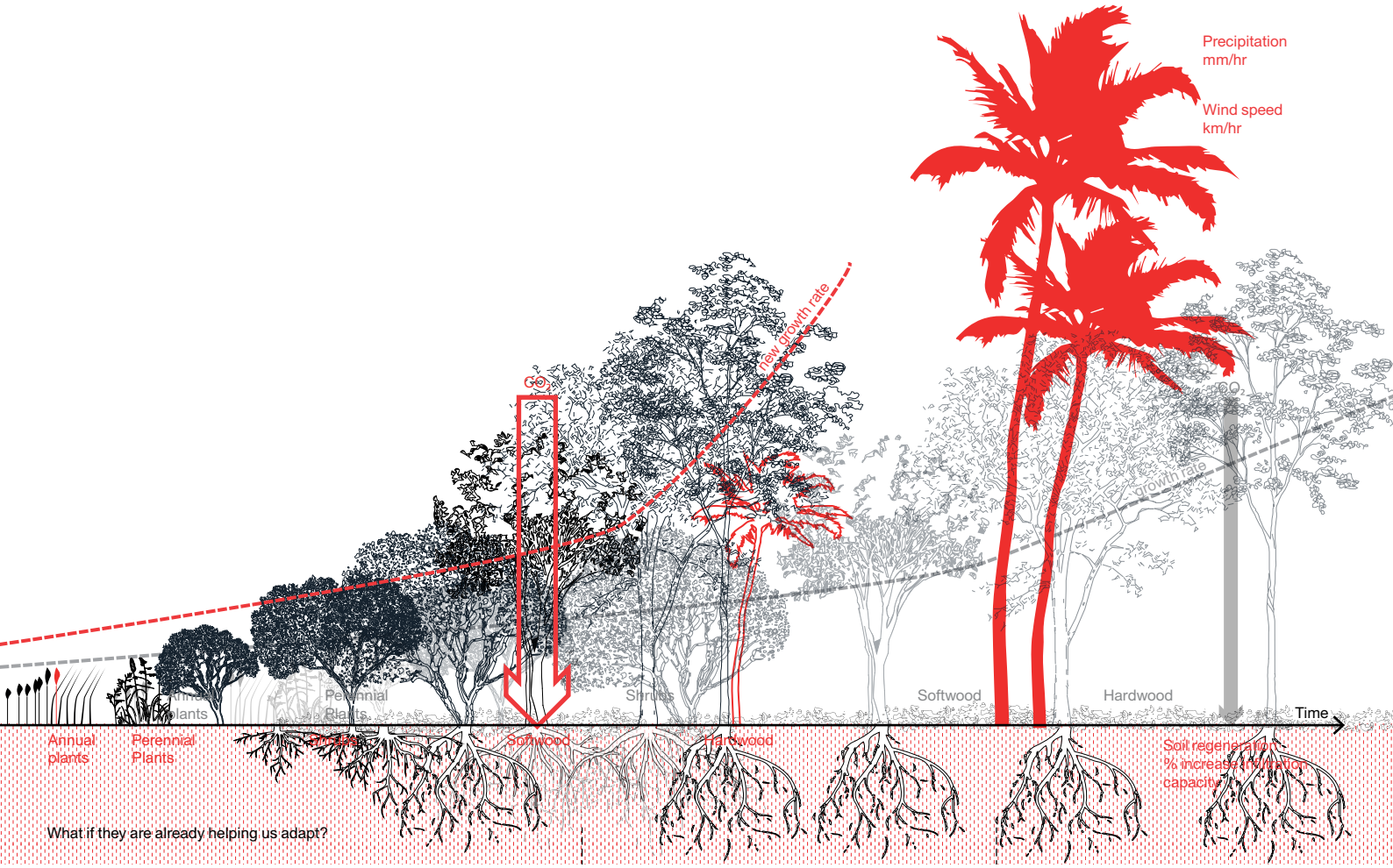
As a consequence, extratropical storms and higher winds are expected in typical 'non tropical' - mid latitude areas (Catto et al., 2019). The implications of these atmospheric shifts are landing in subtropical urbanised coasts such as the Liguria and Veneto region in Italy, where profound changes in the global climate system are being reported (Iannaccone and Valesini, 2015).

THE NEW CONDITION: FROM ABIOTIC TO BIOTIC SHIFTS

Under these atmospheric processes driving climate change the mean amount of water precipitation is, quantitatively, not changing but perhaps rising (Kappa et al., 2015). However, what is clearly changing is the distribution of water precipitation throughout the year: less rainy days and more intense events as 'extratropical' cyclones (Catto et al., 2019).

The new abiotic condition is interlinked with new biotic conditions as CO_2 is of central importance to plant metabolism affecting the growth, physiology, and chemistry of plants (Taub, 2010). Research based on Free-Air Carbon dioxide Enrichment (FACE) experiments, shows how this condition enables most plants to grow faster, shortening harvesting cycles for heat, rice and soybean (Ainsworth 2008; Long et al., 2006 in Taub, 2010). Also, as observed in mid latitudes in Europe the rise of palm trees indicate a shift in ecological succession, where plants are transitioning to other forms that better withstand stronger extratropical cyclones (Xi, 2015).

In an attempt to restore its own homeostasis, *Gaia* is already functioning and adapting to higher levels of CO_2 in the atmosphere.



HOW THIS NEW CONDITION INFORMS THE URBAN PROJECT

If tropical rain events are intense and short periods in which nature transfers back potential services to the land, territorial assets -land- must be designed in a way to retain, collect / store and distribute this potential in order to use it when needed (longer periods of drought). Reclaiming the permeability of our metropolis and the retention capacity of our agriculture becomes an essential modus operandi in the design and management of the urban areas and regions:

Learning from the abiotic shifts, the urban project should harness the potential of new thermodynamic patterns, informed by a revised territorial infrastructural project at watershed and basin scale.

Learning from the biotic shifts, the urban project should take this moment of change to design new co-existence and hybrids of transitioning species which will inform new cultures of the land (agricultures).

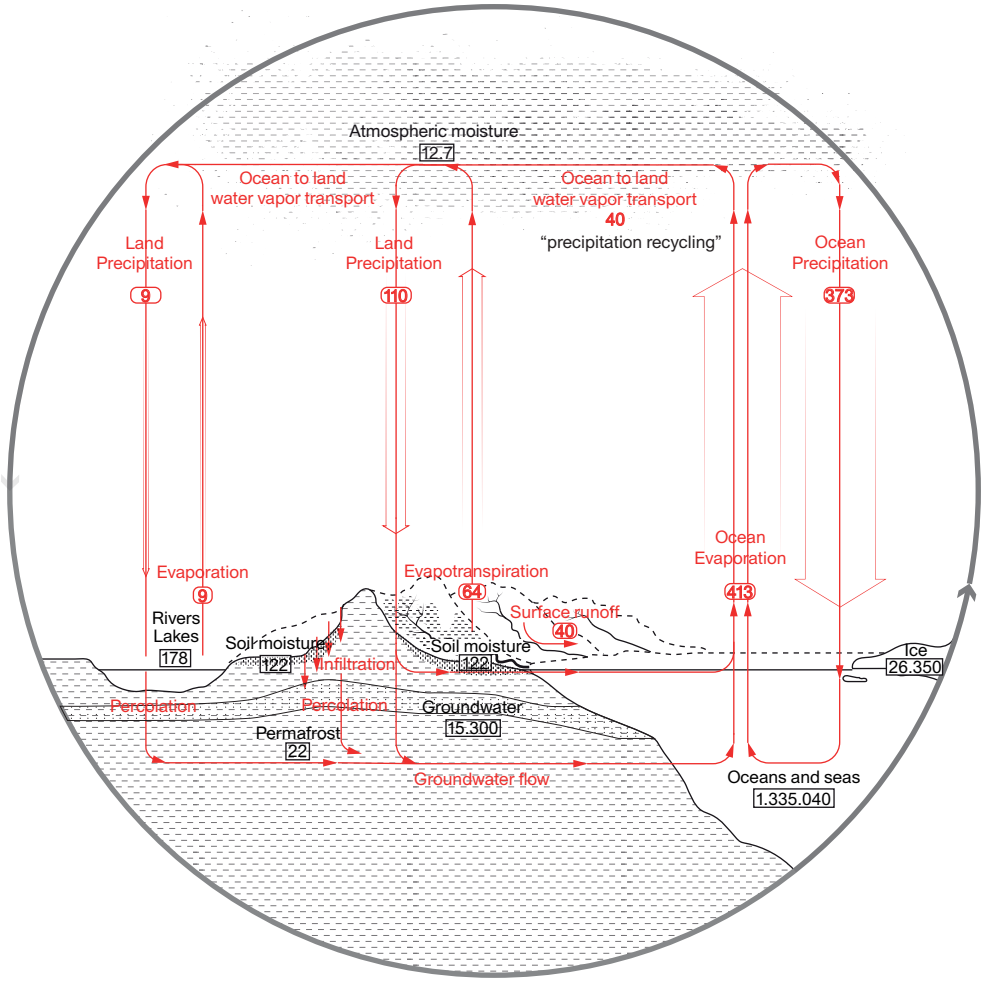
DESIGN PRINCIPLE: QUANTITATIVE PERFORMANCE

The shifts in the Atmosphere realm ask for the projection of new biophysical conditions of living that could inform land use systems of performances for carbon drawdown.

ROLE OF REGENERATIVE SEA/LAND PRACTICES TO MANAGE THIS CONDITION

Regenerative practices that aim at increasing the forested land cover will harness the capacity to produce and re-balance rain patterns as explained with the biotic pump notion (Gorshkov & Makarieva, 2007): mitigating extremes -due to the capacity of forests to allow for latent heat to escape the trap of greenhouse gases and be released into space-, and raising the water retention capacity of our territories.

Atmosphere, water, and soil are extremely interlinked and intertwined. In order to tackle atmospheric issues, we need to shift our perspective on earth and design with the systems of life that both mitigate and adapt to the new abiotic and biotic conditions.



TRANSBOUNDARY HYDROLOGIC SPACE

"Livelihoods depend upon our recognition of the transboundary nature of hydrologic space. Water and energy cycles should be placed at the core of water and land use management and planning strategies." (Gorshkov & Makarieva, 2007)

The earth's rotation together with convection processes are responsible for the lateral circulation of atmospheric moisture known as the "large water cycle" transporting oceanic evaporation and evapotranspiration -from vegetation and soil surfaces- across planetary surfaces from oceans to land. However, on a catchment level, precipitation is recycled by forests and other forms of vegetation and transported across terrestrial surfaces towards continental interiors due to forest-driven air pressure, a process known as "small water cycle" (Ellison et al., 2017). Gorshkov & Makarieva (2007) also describe this process with the notion of the biotic pump of atmospheric moisture, a concept that explains how forests secure moisture flow inland, irrigating territories that, in the case of primary forests -such as the boreal forest in Russia-, can reach up to 7.000km (Makarieva, 2007).

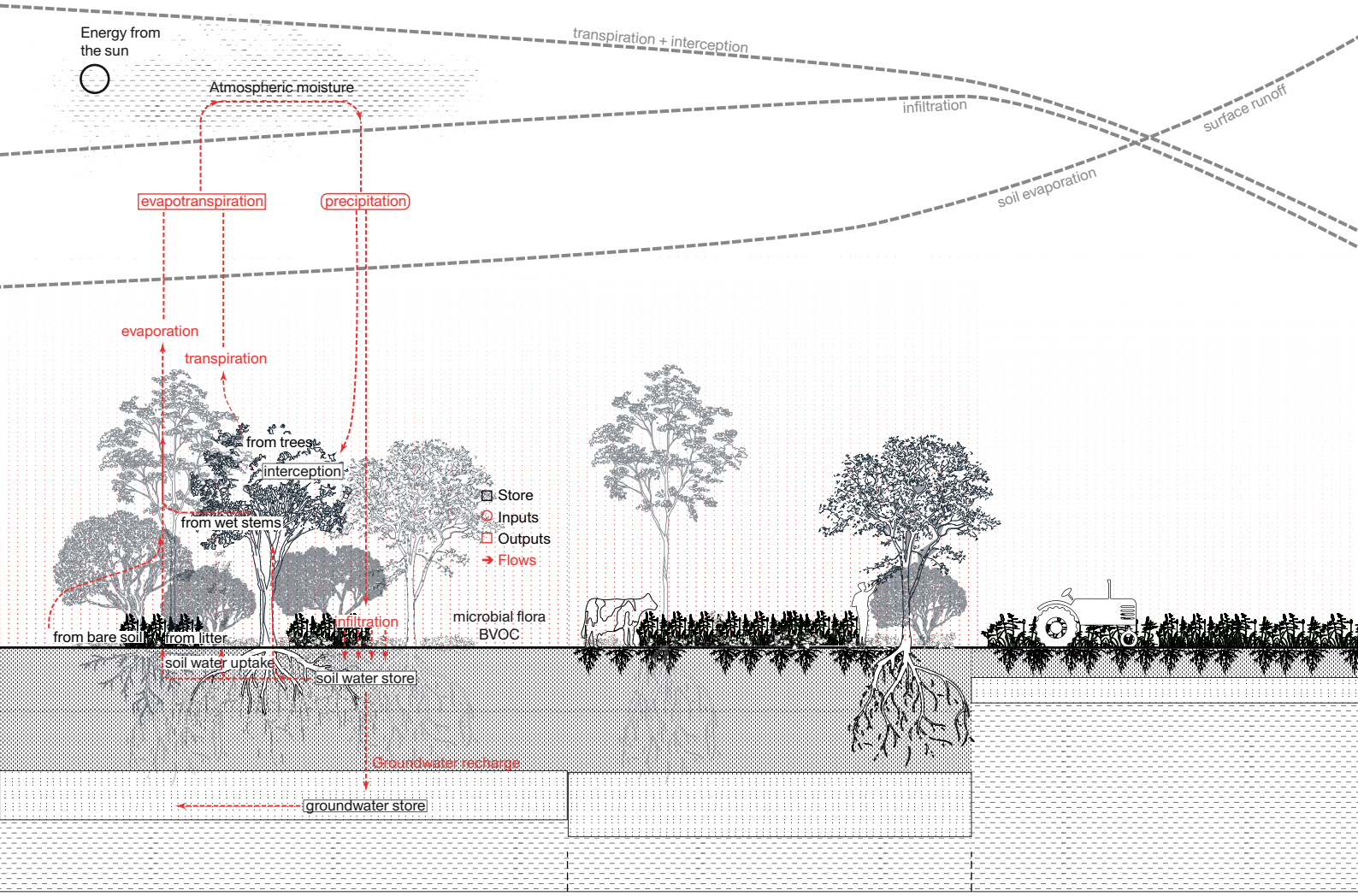
In this sense, evapotranspiration coming primarily from trees is depicted as a syntrophic exchange of water among forms of life. From the macro to the nano scale, the water cycle is greatly influenced by evapotranspiration happening in trees and specifically in leafs. In this sense, forests create, move and spread rain (Gorshkov & Makarieva, 2007).

From the point of view of climate stabilisation, the hydrologic space plays a key role: while the absorption interval of CO_2 molecules covers less than 20 % of the spectrum of thermal radiation of the Earth's surface, atmospheric moisture absorbs thermal radiation rather uniformly over the entire spectrum (Makarieva, 2007). Such climate stabilisation can be performed by natural forests that control the hydrological cycle on land and the adjacent ocean, helping latent heat escape the tropopause.

Conversely, destruction of forests leads to disruption of the hydrological cycle, which expectedly causes significant fluctuations on the magnitude of the global greenhouse effect, leading to complete loss of climatic stability and transition of Earth's climate to a state incompatible with life (Makarieva, 2007).

HOW THE HYDROLOGIC SPACE INFORMS THE DESIGN SPACE

"If you destroy the biotic pump upstream, moisture from ocean will condensate right on the coastline and provoke catastrophic floods" (Gorshkov & Makarieva, 2007)



The biotic pump concept (and more generally the theory of the biotic regulation of the environment of which the former is a part of) for the first time quantifies the stabilising environmental function of ecosystems with respect to the hydrological cycle and pinpoints the physical mechanism that is responsible for this function.

We must elevate the status of ecosystem conservation from a side issue in global environmental talks and treaties (that are exclusively focused on carbon) to an urgent high priority issue.

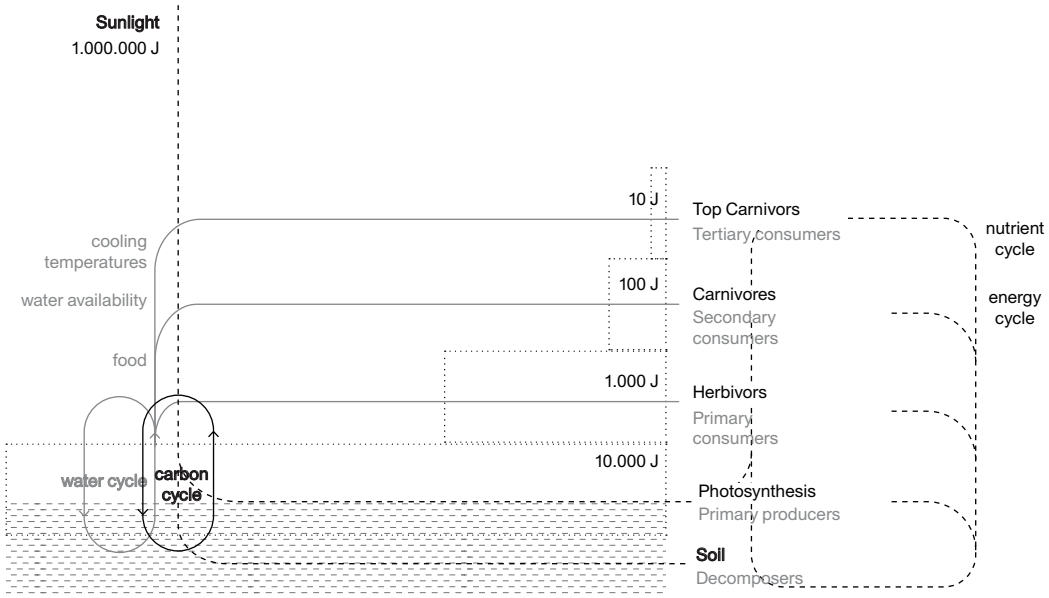
The destruction of local ecosystems -due to urbanisation and intensive land use change such as industrial agriculture and monocropping-, dries out the soil interface, reduces evaporation, condensation and moisture, and causes higher temperature. This albedo effect increases sensible heat and temperature divergence, which in turn, increases the intensity of extreme rainfall events.

Local ecosystems restoration, has therefore a major role on a local level but also, and specially, on a catchment level.

Following this systemic understanding, the importance of the bio-region (Geddes, 1901 & Forman, 2008) becomes crucial in any form of territorial project, land use management and governance programme.

DESIGN PRINCIPLE:
RETAIN, STORE AND DISTRIBUTE

If trees become water, the territorial project calls for the hybridisation of land use patterns through vegetation density strategies. This will result in different forms of vegetation cover and vegetal - mineral mixes that seek ecosystem regeneration. In this sense, this research on water casts light on the re-making of territories following watershed regeneration as strategies to increase watershed biological potential.



ON COOPERATION

As a free deal that arises from the same functioning of earth for millions of years, plants are the sole organisms able to assimilate and translate for us, the main source of life and energy, the sun (Bill Mollison in Murakami, 1991). As Coccia (2019) articulates, "photosynthesis is a great atmospheric laboratory in which solar energy is transformed into living matter" (p. 37).

From abiotic to biotic processes, soil is the interface of around 2m depth, in which geosphere, atmosphere, biosphere and hydrosphere come together. As these spheres interact, providing water, carbon, nitrogen and nutrients, the ground acts as a temporary reservoir –of water and carbon– but also as the media where transformation and assimilation of nitrogen and nutrients takes place. In this sense, the soil is here defined as the crucial mediator, the most essential infrastructure supporting life on Earth.

The formation of soil and, with it, life as we know it, tells a history of cooperation of mutually beneficial relationships -from lichens 700 million years old- to mycorrhizae -500 million years old-, that ultimately provided the fertile conditions for plants to colonise land (Asher, 2015).

This moment of colonisation entailed, for the plants, the possibility to develop extensive vasculature, leaves and rooting systems; and for the soil, the enhancement of sufficient organic matter and structure that, eventually, enabled stability against erosion (Asher, 2015).

"Thanks to roots, the vascular plant, alone among all living organisms, inhabits simultaneously two environments that are radically different in their texture, structure, and organisation and in the nature of the life that inhabits them: earth, air, sun and sky." Coccia (2019, p.80).

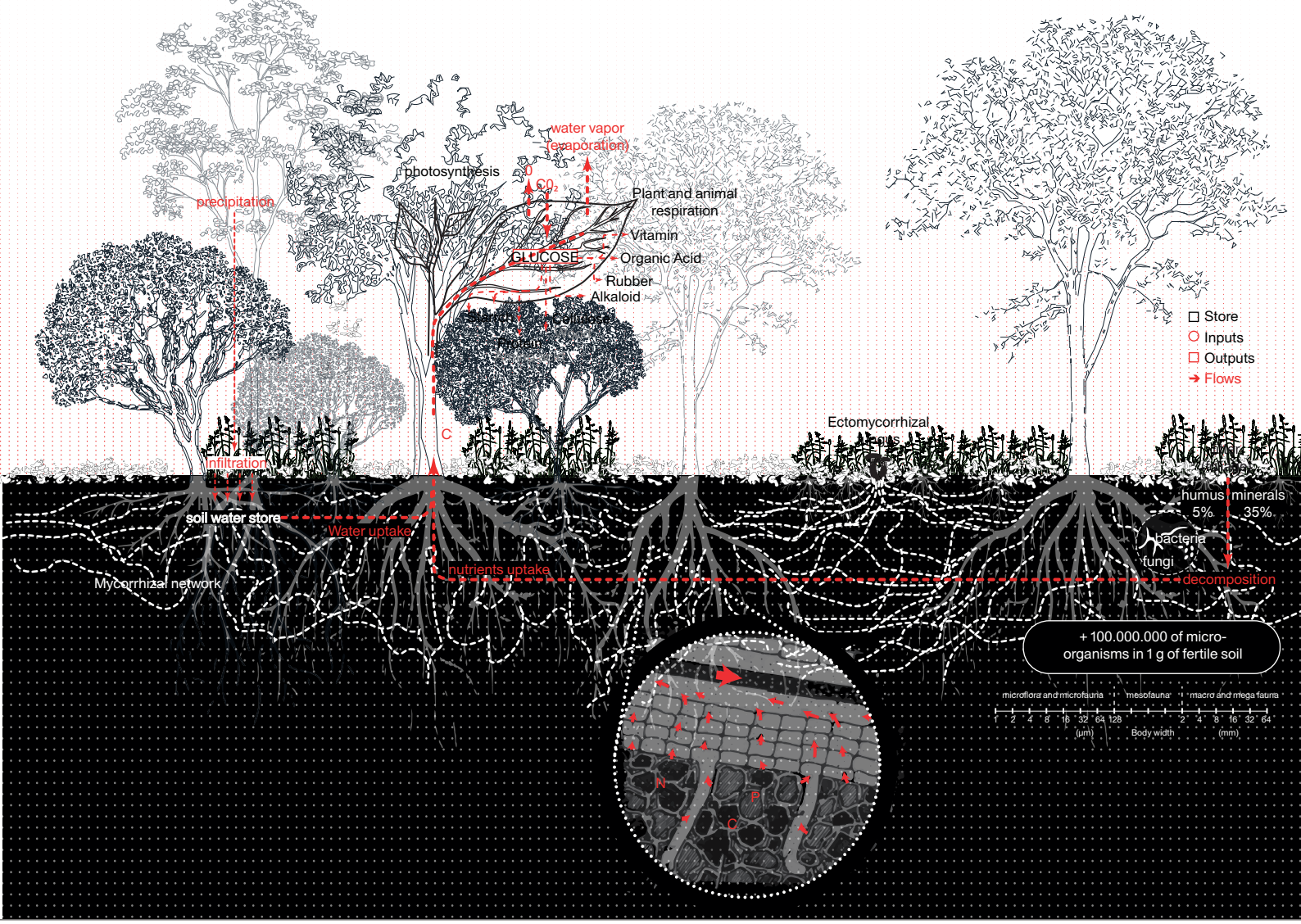
As cosmic mediators (Coccia, 2019), roots are therefore hybrid beings with a double character, between biotic and abiotic, between two radically different environment conditions and spaces.

PROCESSES DRIVING
THE DEGRADATION OF THE SOIL

In a lapse of a couple of hundred years, man-steered changes on land-use and land-cover, and particularly, industrial agricultural practices are threatening the 500 million years history of soil formation and its performance to support life.

Due to the increasing pressures exerted on the soil, below-ground life is under threat. Among all the pressures, intensive human exploitation through industrial agricultural practices is threatening the soil microorganisms, soil fauna and soil functions (Orgiazzi et al., 2016).

In particular monocultures and their need for industrial fertilizers, nitrogen / potassium / phosphorus, deplete the soil, which transforms from carbon sink to carbon source. According to Murakami (1991), in comparison with holistic and regenerative agricultures which imitate



the productivity model of food forests, conventional land management and industrial agriculture lead to soils with: less ground cover, fewer roots, less carbon stored in soil, less water retention in topsoil, depleting groundwater, more erosion, less bioproductivity, less diversity, more carbon in the atmosphere.

The urban project -as it unfolds today- is in direct correlation with the degradation of the soil infrastructural space, compromising its performance as a temporary reservoir -of water and carbon- but also compromising its capacity to assimilate nitrogen and nutrients. These degrading processes come together with increasing erosion and imperviousness of open spaces, setting the ground for floods in the events of extreme rainfall.

THE URBAN PROJECT AS AN INFRASTRUCTURAL PROJECT

The understanding of the unseen, through the representation of abiotic-biotic processes, asks for the redirecting of the role of urban landscape practices. As part of a super-organism, land transformations -that enable urban life- should seek to regenerate the relationships among the rest of the living systems.

The research calls for an infrastructural project that restores the biological capacity of soils along with water retention, carbon absorption, nitrogen and nutrients assimilation and recycling.

ROLE OF REGENERATIVE SEA/LAND PRACTICES TO RESTORE THE SUPPORTING CAPACITY OF SOILS

According to Murakami (1991), in agricultural systems, the hybridisation (increased of ecological density) is associated with holistic land management and other techniques of regenerative agriculture.

These systems mimic the systemic relations happening in ecosystems: continuous soil formation, maximization of soil organic matter, diversification of actors (species) resistance to pathogens and insects, nutrients retention, high functioning of soil microbiome, high precipitation use efficiency, and no fossil fuel dependence.

The urban project should design, plan and manage the hybridisation of the open space-built up gradient including a range of ways in which forested systems, vegetation diversity, and material practices can be implemented in order to regenerate the biological capacity of soils.

DESIGN PRINCIPLE: COOPERATION

The research *On Soil* describes the importance of cooperation, a strategy that can be translated into a design principle as the seeking for alignments, synergies, and diversification. In this space of cooperation, different land cultures shall arise and define new interspecies dependencies, temporal dynamics, postindustrial and post-anthropocentric cultures.

REFERENCES

Asher, C. (2015, December 5). One amazing substance allowed life to thrive on land. BBC Earth. http://www.bbc.com/earth/story/.

Buis, A. (2020, February 27). Why Milankovitch (Orbital) Cycles Can't Explain Earth's Current Warming. Ask NASA Climate. https://climate.nasa.gov.

Catto, J. L., Ackerley, D., Booth, J. F., Champion, A. J., Colle, B. A., Pfahl, S., ... & Seiler, C. (2019). The future of midlatitude cyclones. Current Climate Change Reports, 5(4), 407-420.

Coccia, E. (2019). The life of plants: a metaphysics of mixture. John Wiley & Sons.

Ellison, D., Morris, C. E., Locatelli, B., Sheil, D., Cohen, J., Murdiyarso, D., & Gaveau, D. (2017). Trees, forests and water: Cool insights for a hot world. Global Environmental Change, 43, 51-61.

Forman, R. T. (2008). Urban regions: ecology and planning beyond the city. Cambridge University Press.

Geddes, P. (1901). Cities in Evolution: an Introduction to the Town Planning Movement and to the Study of Civics. Forgotten Books.

Goddard, P. B., Yin, J., Griffies, S. M., & Zhang, S. (2015). An extreme event of sea-level rise along the Northeast coast of North America in 2009–2010. Nature Communications, 6(1), 1-9.

Maxmen, A. (2018). As Cape Town water crisis deepens, scientists prepare for 'Day Zero'. Nature, 554(7690).

Murakami, S. (1991). Lessons from Nature: A Guide to Ecological Agriculture in the Tropics. PROSHIKA.

Hu, Y., Huang, H., & Zhou, C. (2018). Widening and weakening of the Hadley circulation under global warming. Science Bulletin, 63(10), 640-644.

Hutchins, G., & Storm, L. (2019). Regenerative Leadership: The DNA of Life-affirming 21st Century Organizations. Wordzworth Publishing.

Iannaccone, S., & Valesini, S. (2015, November 30).I mutamenti climatici cambiano il mondo: l'Italia sarà tropicale. L'Espresso Dossier Clima. https://espresso.repubblica.it

Kangasniemi, J. (1993). Sustainable Agriculture and the Environment in the Humid Tropics. Culture & Agriculture, 13(47), 24-25.

Makarieva, A. M., & Gorshkov, V. G. (2007). Biotic pump of atmospheric moisture as driver of the hydrological cycle on land.

Orgiazzi, A., Panagos, P., Yigini, Y., Dunbar, M. B., Gardi, C.,Montanarella, L., & Ballabio, C. (2016). A knowledge-based approach to estimating the magnitude and spatial patterns of potential threats to soil biodiversity. Science of the Total Environment, 545, 11-20.

Steffen, W., Rockström, J., Richardson, K., Lenton, T. M., Folke, C., Liverman, D., & Donges, J. F. (2018). Trajectories of the Earth System in the Anthropocene. Proceedings of the National Academy of Sciences, 115(33), 8252-8259.

Taub, D. (2010). Effects of rising atmospheric concentrations of carbon dioxide on plants. Nature Education Knowledge, 1.

Wu, D., Piao, S., Zhu, D., Wang, X., Ciais, P., Bastos, A., ... & Xu, W. (2020). Accelerated terrestrial ecosystem carbon turnover and its drivers. Global Change Biology.

Xi, W. (2015). Synergistic effects of tropical cyclones on forest ecosystems: a global synthesis. Journal of forestry research, 26(1), 1-21.

Zappa, G., Hawcroft, M. K., Shaffrey, L., Black, E., & Brayshaw, D. J. (2015). Extratropical cyclones and the projected decline of winter Mediterranean precipitation in the CMIP5 models. Climate Dynamics, 45(7-8), 1727-1738.

On Sea Level Rise

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While the severity of the climate crisis calls for a discussion on transformative and potentially disruptive change, science, engineering, design, governance and practice are currently too detached to effectively contribute to such discussions.

The spatial manifestation of climate crisis rarely appeals to one's imagination. Yet, when reviewing the range of sea level rise projections and their accelerated rate of change, it is clear that understanding when and why to navigate between mitigation, adaptation and transformation measures is essential for flourishing coastal communities globally.

The Netherlands is one of those and has been characterised by a long history of renowned flood risk and water management as well as spatial planning. Facing the potential extreme scenarios of sea level rise, the country now however struggles to include measures preparing for a shift from incremental to the required transformative strategies.

This research project identifies the criticalities by means of a risk matrix and stress maps as an initial act to introduce the Sea Level Impact Knowledge Collect and its transdisciplinary Research by Design approach to guide the discussion on transformative change and its implementation in living labs.

(a) 6500 BP (b) 5100 BP (c) 3800 BP (d) 2600 BP

(e) 800 CE (f) 1500 CE (g) 2020 CE (h) Delta Plan X

Geomorphological maps the Netherlands

(a-g) Simplified geomorphological maps from the Netherlands (adjusted from Vos et al, 2020).

(h) Delta plan X by ZUS [Zones Urbaines Sensibles]

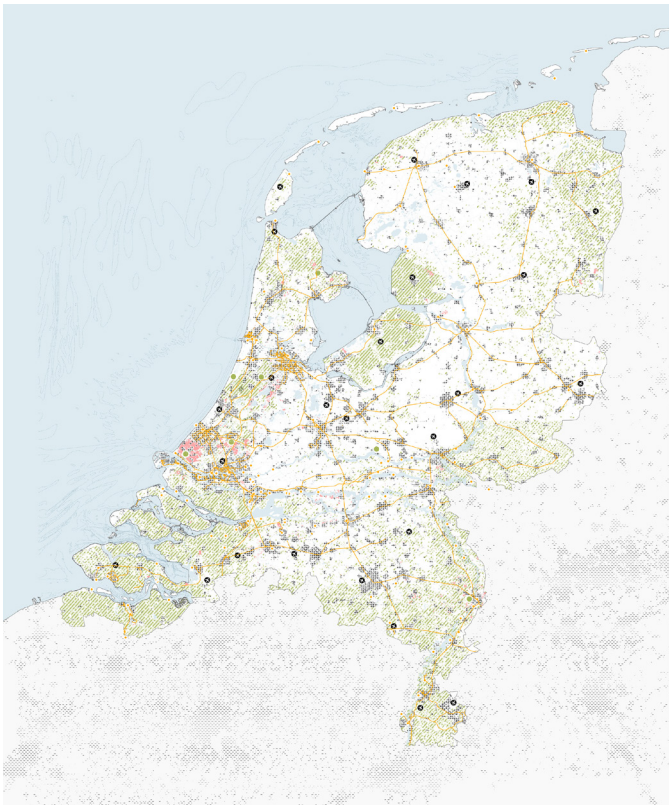
THE DUTCH TRADITION

The Netherlands made a name for itself and became water management world market leaders due to the challenges the country faced at early stages of its establishment. The necessity to continuously manage the relationship between land and water systems led to its ground breaking and renowned flood risk management response. Throughout history, there have been radical proposals and actual interventions transforming the Netherlands and its relation to water and flood risk, ranging from the Southern Sea Works (originating from the 19th century) to futuristic proposals of creating an artificial tulip shaped island in front of the coast. However, one of the major faults of these radical endeavors is that they offered little guidance on the spatial, social, economic or political conditions on how the nation would transform or adapt to later climatic issues.

Historically, the Dutch spatial planning system has been lauded to be successful in the quality of urban development and forecasting needs for citizens. Decades after World War II, a series of national spatial planning reports (Ruimtelijke Notas) guided the urban and economic growth of the Netherlands. The Notas offered prescribed national spatial guidelines with set requirements to create a sustainable economy alongside boundary conditions. However, the tradition was lost in 2001 when the issued 5th report was not executed and the 2006 Nota Ruimte was heavily criticized. Currently, the Netherlands lacks an existing national framework for spatial planning and thinking, while facing climate crisis related pressures on the development of the urban and rural environment. The Dutch associations of (landscape) architects and urbanists therefore brought forward an open letter to Dutch policy makers to protect the Netherlands from becoming a sum of sectoral sub-solutions (BNA, BNSP & NVTL, 2019). Their call asks for the creation of space in policy making and development processes to deploy research by design for the shaping of the Netherlands of the future.

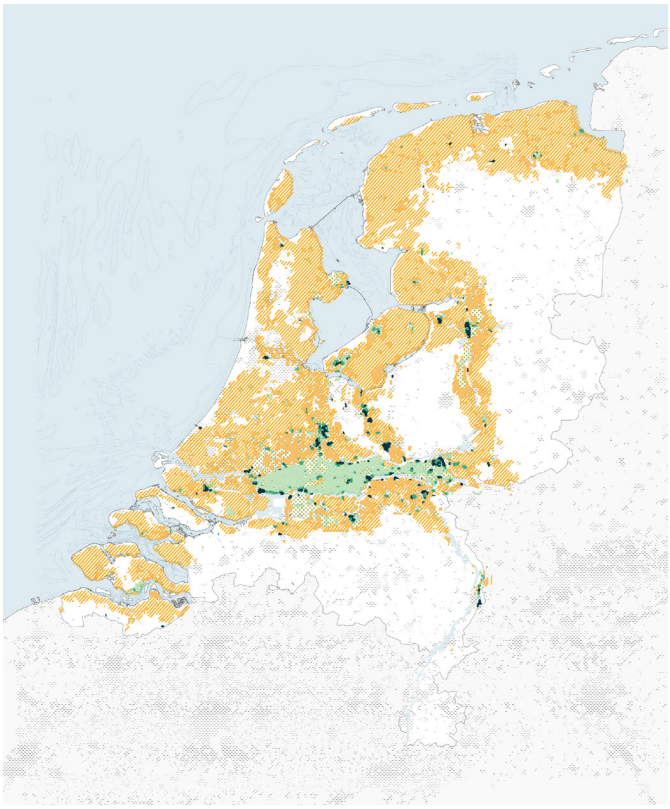
PROJECTIONS

Latest IPCC reports have indicated that global mean sea level rise after the year 2100 has a chance of surpassing three meters which will exceed our current coastal defense infrastructure (IPCC, 2019). Models integrating the contributions of the cryosphere present the wide range of sea levels between 0.50 and 15.52 meters in 2300 which also highlights there is little correlation between the contribution of ice melt to sea level rise in the coming century and beyond (DeConto & Pollard, 2016; Kopp et al., 2017). This deep uncertainty is intrinsically tied to rising costs of climate change mitigation measures and expected costs for future investments in infrastructure, health, agriculture, among others.



Land use: Distribution of valuable land uses, urbanised areas and functions

- Arable land
- Railway
- Port
- Airport
- Glass house
- Semi-built area
- Greenport
- Urbanized area



Land use: Annual expected economic risk calculated from the probability of levee failure and the consequences of flooding (damages and fatalities) if flood defenses fail

- < 10 € / ha / y
- < 50 € / ha / y
- < 100 € / ha / y
- < 2500 € / ha / y
- < 5000 € / ha / y

Regardless of the eventual sea level rise scenario, sea level rise will affect the physical, social and economic coherency of the Netherlands and many other coastal and floodplain communities. Despite the high level of uncertainty, an understanding is required on how the Netherlands can mitigate, adapt or transform land, urban areas and infrastructures for future scenarios. Looking back at the historical geomorphologic evolution of the land we now call the Netherlands (adapted from Vos et al., 2020), its shifting delta characteristics are evident. Only in the last centuries, the Dutch land reclamation and polder practices have fixated its outline, allowing a quickly decreasing dynamicity of the border between land and water.

Acknowledging that the current outline of the Netherlands has only been set in the last sixty years with the completion of the Delta Works, allows for the reconsideration of its maintenance, anticipating extreme sea level rise scenarios in the debates about long-term strategies. Attempts at creating the required long-term national vision addressing extreme sea level rise scenarios resulted in proposals like LOLA Landscape Architect's Plan B NL 2200 (2018) and ZUS' Delta Plan X (Hendriks, 2019). However radical, these visions are a potential future but the strategies or steps needed to achieve the vision remain absent.

SEA LEVEL IMPACT KNOWLEDGE COLLECTIVE

The Sea Level Impact Knowledge Collective (SLIKC) is a design-led initiative born from collaborative efforts between knowledge institutes, academia, municipalities, NGO's and experts. Framed around the climate crisis, uncertainties tied to extreme sea level rise and a lacking national framework to address those, the research branches out to encompass fields such as urbanism, water management, geology, landscape architecture, policy analysis and social and climate sciences. Its aim is to critically think, design, engineer, assess, visualise and communicate a spatial vision for the future of the Netherlands and its method of establishment with the urgency of the changing climate extremities.

Given the complexity and urgency of future climate change, socio-economic trends and governmental development, the project leverages on a multi-faceted team comprised of several disciplines and expertise. This is vital given that even the new Delta Program does not cover all risks and opportunities for the Netherlands and focuses predominantly on flood protection, freshwater supply and urban flooding.

The SLIKC team positions itself in seeking for alternative measures that would not result in the Netherlands resorting to large scale mass retreat and aims to develop methods and tools for the delivery of transformative change by design by means of:

Critical infrastructure: Energy systems

Gas field
High voltage electrical line
Powerstation
High voltage sub station
Existing wind farm
Productive oil field
Production platform
Oil pipeline

Nature: Landscape infrastructure

Park
Forest
Nature 2000

1. Developing a resilient vision for the Netherlands that can be translated into and can inform current practice.

2. By doing so, developing and implementing a research framework and methodology, allowing for realistic, concrete and feasible Dutch landscape designs and accommodating different contexts, which can be objectively assessed.

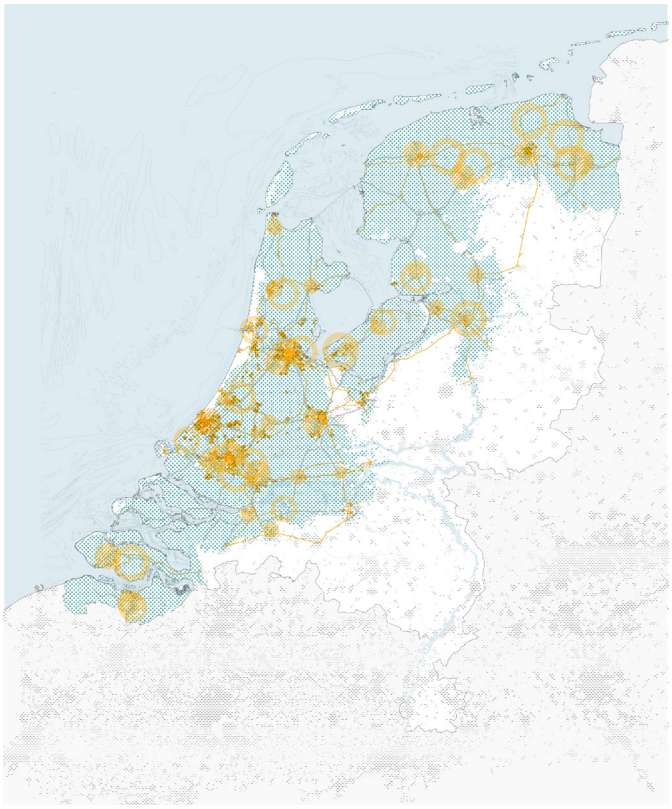
3. Establishing an optimal current engineering and design practice that aligns both the short term (< 2100) and long term (> 2100) future.

4. Creating added value by coupling to other spatial challenges such as water availability, biodiversity conservation, energy transition and agriculture.

RISK MATRIX

As an initial act, in order to identify the criticality of the Dutch context pressured by sea level rise and grasp a more holistic understanding of the multitude of risks and key pressured areas in the Netherlands, a risk matrix and a series of stress maps were developed. The main risks identified, alongside extreme sea level rise (three meters), were drought, river discharge, salinity and subsidence and the matrix aligns each of them with the relevant variables. Using the risk matrix, the stress map for each risk was established by means of a cartographic exploration overlaying these relevant variables including the distribution of population density, growth and GDP projections, land use and the associated value and potential economic loss, critical infrastructure such as energy, drinking water provision and transportation systems and nature in terms of topography, landscape infrastructure, river discharge but also natural trends such as salinisation, subsidence, drought. Each stress map ultimately outlines the key areas in the Netherlands with the highest stresses among all the variables considered.

The majority of the data was obtained from an open-source database from a joint collaborative effort between multiple parties found on the online Klimaat Effect Atlas. Several notable partners that have contributed to the research on the website range from Wageningen University, Deltares, KWR, TNO, the Deltaprogramme, Rijkswaterstraat, HKV and many more. The data is public assessable on the online interface and Esri's Map web database that can connect to ArcGIS Pro.



Sea level rise stress map

Highly urbanized and densely populated area
3m flooded area
High concentration transportation systems
High concentration energy systems
Impacted railway
Impacted motorway

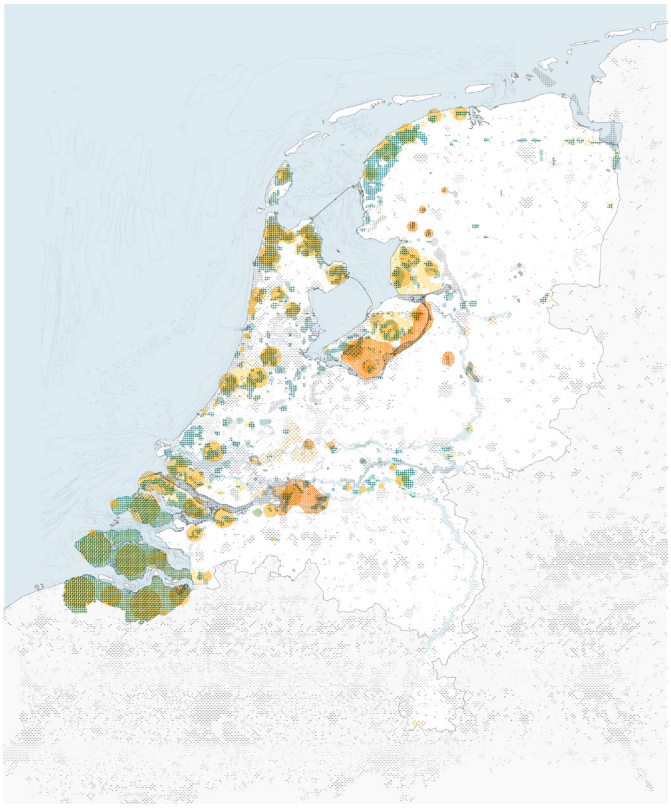
River discharge stress map

Current river discharge (low)
Current river discharge (high)
Future river discharge (high)
Highly urbanized and populated development
High concentration transportation systems
High concentration energy systems

STRESS MAPS

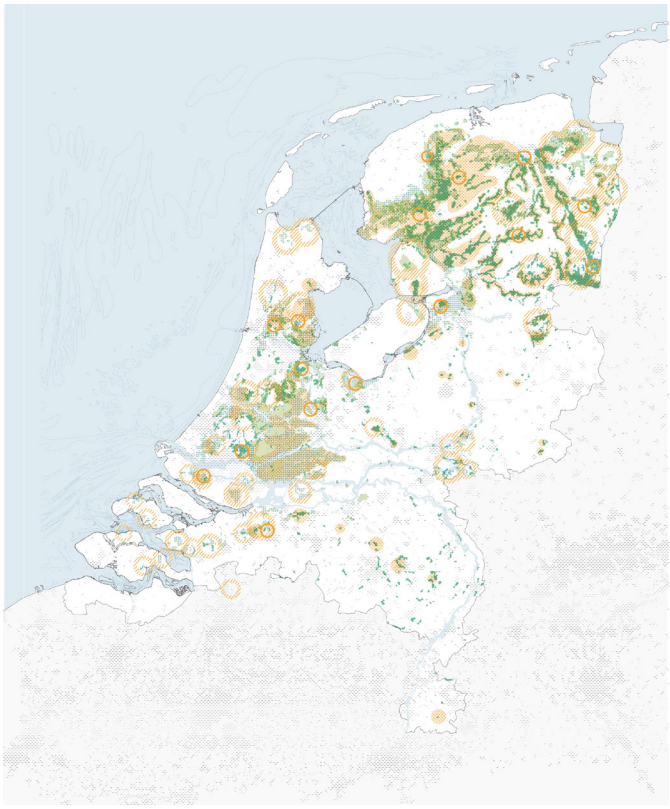
The sea level rise stress map highlights the area below sea level with a general mean sea level rise of three meters. Large parts of the country are already below the current sea level but this future projection casts light on how contemporary developments as population growth and distribution and infrastructure investments in the national transportation and energy systems in the Randstad and secondary Dutch cities coincides with areas where risk will increase. In the south of the Randstad, this observation is additionally highlighted on the river discharge stress map as the area where the rivers responsible for the largest part of the national discharge debouche to the North Sea with discharge volumes subject to more unpredictable fluctuations in the future. This area, together with the center of the Randstad is furthermore one of the two focal areas on the subsidence stress map, increasing stress and risk in the area.

The less urbanised parts of the Netherlands are not free of risks. The other focal point of the subsidence stress map highlights for instance the northern provinces of Friesland and Groningen and the salinisation stress map indicates the coastal arable land facing increasing salt contents, especially in the south-western province Zeeland, the north of Noord Holland and the west of Friesland. As opposed to excessive water, the drought stress map shows more concentrated areas of concern like the system of dunes along the Dutch coast, the Utrechtse Heuvelrug, Veluwe and large parts in the east of Noord Brabant and the north of Limburg. Drought poses a particular threat in these areas due to their protected Natura 2000 status and their role as national or provincial groundwater reserves.



Salinity stress map

Increase salt content 500-1000 kg / y
Increase salt content > 1000 kg / y
Affected grassland
Provincial groundwater reserve
Natura 2000
Drilling free zone
Groundwater protection area
Arable land
National groundwater reserve



Subsidence stress map

0-5 cm
5-10 cm
10-15 cm
> 15 cm
Affected arable land
Affected built area
Affected grassland

A WAY FORWARD

The complexity highlighted in the layered stress maps is an initial act in identifying the criticalities and underlines the impossibility of a single solution and one future map of the Netherlands. It highlights a call for a way to address the challenge and, in our opinion, a call for Research by Design. Design has the capacity to continuously explore and set out both the problem space and the solution space and to define the opportunities which are capable of connecting them. Research by Design allows for a solution to be the development of a transdisciplinary approach and process embracing a radical vision as a way to transition and to accept multiple options simultaneously rather than one solution map.

As innovations and potential high-end sea level rise scenarios unfold, the SLIKC approach aims to guide the discussion on transformative change in the Socio-Technical-Ecological System (STES) of the Dutch Delta and its implementation in scale-free living labs. Where STES is predominantly linked to the governance and management system, the Research by Design approach will take a multi-layer stratified model approach that distinguishes spatial planning in a land-use occupation layer, an infrastructure network layer and a subsurface layer. Transdisciplinary work will be at the intersection between these systems and layers. Being scale-free, the approach seeks to defy multi-system and layer issues through design-based interaction in local, regional, and national living-labs.

To achieve the objectives, the research is climate action oriented, connecting and re-connecting academics and professionals from different institutes and practices with citizens. This is done in a design-oriented fashion, producing a multi-method approach that combines design, engineering, modelling and action research with participative approaches and citizen science for transformative change based on STES. Its products are innovative practices and designs, supporting methods and models, that inform professionals and citizens and active niches for transformative change.

ACKNOWLEDGEMENTS

SLIKC is initiated and led by Joep Storms. The authors gratefully acknowledge the financial support of the TU Delft Climate Institute. The ideas set out here profited greatly from intensive discussions and workshops with colleagues from ZUS (Zones Urbaines Sensibles), Generation.Energy, PosadMaxwan and Deltares, the TU Delft A+BE Faculty (Urbanism, Architecture) and CEG Faculty (Hydraulic Engineering, Water Management, Geosciences & Remote Sensing and Geoscience & Engineering).

REFERENCES

Branchevereniging Nederlandse Architectenbureaus, Beroepsvereniging van Nederlandse Stedebouwkundigen en Planologen, Nederlandse Vereniging voor Tuin- en Landschapsarchitectuur (2019). Bouwen aan het Nederland van de Toekomst. Oproep van de vakgemeenschap van ruimtelijk ontwerpers aan bestuurlijk Nederland. Retrieved from https://www.bna.nl/documenten/manifest-bouwen-aan-het-nederland-van-de-toekomst

DeConto, R. M., & Pollard, D. (2016). Contributions of Antarctica to past and future sea-level rise. Nature, 531, 591–597. https://doi.org/10.1038/nature17145

Hendriks, M. (2019). Toen het water kwam. Blauwe Kamer Ezine, 8. https://www.blauwekamerezine.nl/ezine-2019-8/

International Panel on Climate Change (2019). IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [Pörtner, H. O., Roberts, D. C., Masson-Delmotte, V., Zhai, P., Tignor, M., Poloczanska, E., Mintenbeck, K., Alegría, A., Nicolai, M., Okem, A., Petzold, J., Rama, B., Weyer, N. M. (eds.)]. Geneva, Switzerland: IPCC. https://www.ipcc.ch/srocc/

Kopp, R. E., DeConto, R. M., Bader, D. A., Hay, C. C., Horton, R. M., Kulp, S., Oppenheimer, M., Pollard, D., & Strauss, B. H. (2017). Evolving Understanding of Antarctic Ice-Sheet Physics and Ambiguity in Probabilistic Sea-Level Projections. Earth's Future, 5(12), 1217-1233. https://doi.org/10.1002/2017EF000663

LOLA Landscape Architects (2018). Plan B: NL2200, The nation formerly known as The Netherlands. Retrieved from https://lola.land/project/plan-b-nl2200/

Vos, P., Van der Meulen, M., Weerts, H., & Bazelmans, J. (2020). Atlas of the Holocene Netherlands, landscape and habitation since the last ice age. Amsterdam, The Netherlands: Amsterdam University Press. https://www.cultureelerfgoed.nl/onderwerpen/bronnen-en-kaarten/overzicht/paleografische-kaarten

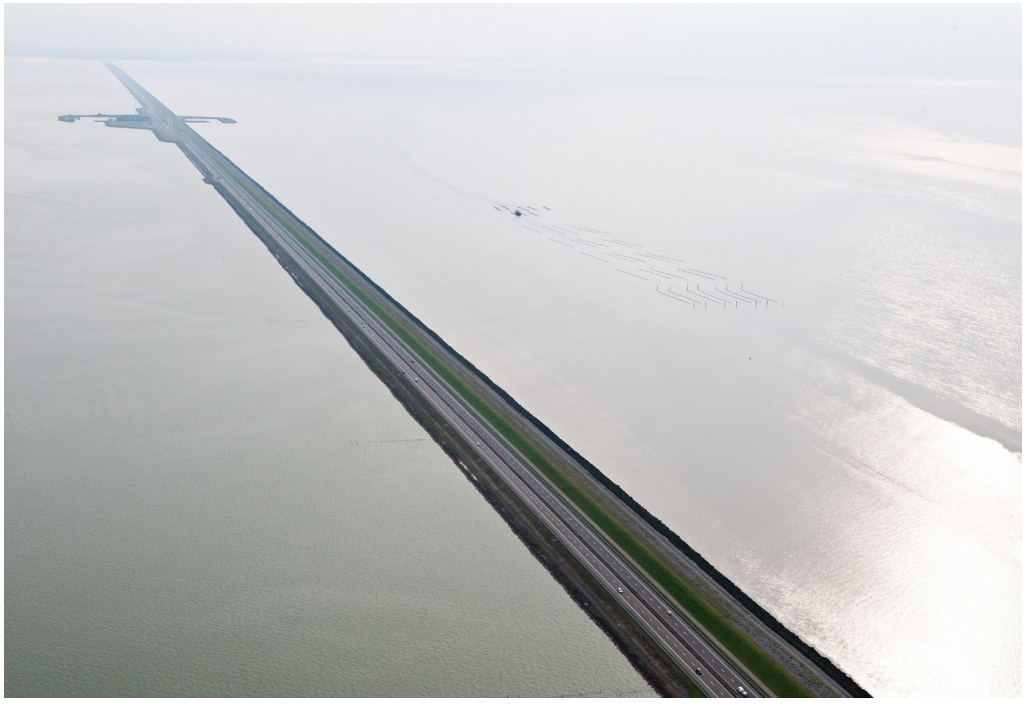
Practices

Dutch designed 'soft power'

Daan Zandbelt

In the Netherlands, there is the tradition of appointing a National Architect. This function expanded over time into an advisor for a national policy for built infrastructure and later for large national projects as well. Today, it is an advisory team, called the ‘College van Rijks Adviseurs’ (CRa), which consists of an urbanist, an architect and a landscape architect. Their impact is giving the national government (unsolicited) advice by the power of design, of demonstration; a 'soft power'. The red line in the story of the CRa is the need for a new chapter in Dutch spatial planning. They therefore created Panorama NL, an advice to the national government on how to develop a spatial vision for the Netherlands, what it includes, and how to formulate it, and which partners to include. Panorama NL is about storytelling, about how to offer a positive perspective in society to everyone. It is a book and it is also an app, in which you can see literally 360-degree panorama at eye level. Panorama NL paints a picture of what we should do and why we should do it. But the next question is: 'How do we actually do it?’ This led to a competition called ‘Panorama Lokaal’ (the local panorama), which looks into post-war residential neighborhoods at a city’s fringe, facing the countryside. Municipalities are challenged to think about how global and national challenges could help to qualitatively improve these areas. A new situation: national government is no more just providing funding but also needs to participate with a vision, be able to organize partnerships, with the most important scale of operations being the regional scale. This means that people need to be educated differently; at the ministry, at the national government level, and also at the university. The aim is to create T-shaped skills: a specialist in one specific domain or profession, but also able to communicate their specialist knowledge with people from totally different backgrounds, like economists or sociologists, laymen or politicians. It is regaining the Dutch Urbanism Approach: the ability to create a vision and develop it through an interdisciplinary approach into an integrated design.

01a



01b

01a 2011 Afsluitdijk
Photo Joop van Houdt
Beeldbank Rijkswaterstaat

01b 2011 Afsluitdijk
Photo Joop van Houdt
Beeldbank Rijkswaterstaa

In the Netherlands, we have a tradition of appointing a National Architect. Once started by Napoleon who used this National Architect to design the ministries and the palaces of the king, which, over the centuries, evolved into an advisor for a national policy for built infrastructure and later for large national projects. Actually, since the beginning of the 21th century, it was no longer one person but it became a board of advisors as it was not only one person who would comprise all these demands. Today, this team, called the 'College van Rijks Adviseurs', consists of an urbanist, an architect and a landscape architect.[1] Together, it is a team that can give solicited and unsolicited advice to the national government and its partners. And of course, it is not just these three people, but also an office with fifteen people. The advisors are doing it as a part time job, besides running their own offices. After four years, other advisors are appointed. Their main task is to bring state-of-the-art knowledge from practice to the national state.

The power of the advisors is the power by design, by demonstration. They have a lot to say, but nothing to tell, so they can only convince by the power of ideas. That is what I call 'soft power'. I will try to illustrate in which ways we can use designer skills and soft power to get what we want. On the one hand, you can describe it as an advisory board. There are many advisory boards in the Netherlands, like the PBL, the planning bureau for spatial planning; or the RLI, the board for the environment and infrastructure. They work on the underpinning of policy by research.

The College van Rijks Adviseurs (CRa) created Panorama NL[2], an advice to the national government on how to create a vision for the Netherlands, what it includes, and how to formulate it, and which partners to include. There is lot of research by design and design competitions in order to set this agenda. To get new topics on the agenda of the national government, to get the design community aware of things that could bring cities to work on projects more coherently on urbanization and infrastructure. It's about different forms of mobility: car-based, public transport-based, bike and pedestrians, about landscape and energy transition, among others. However, the advice is not only reviewing the meals coming out of the restaurant, wit is actually also advising on how to cook them. So, the Rijks Adviseurs are also part of quality teams of national projects, for example concerning our parliament buildings, large train stations, or the Afsluitdijk (see figures 01a and 01b), our big national dam that gets an upgrade. Here, they work on keeping the quality at the high level that was stated at the beginning of a project.

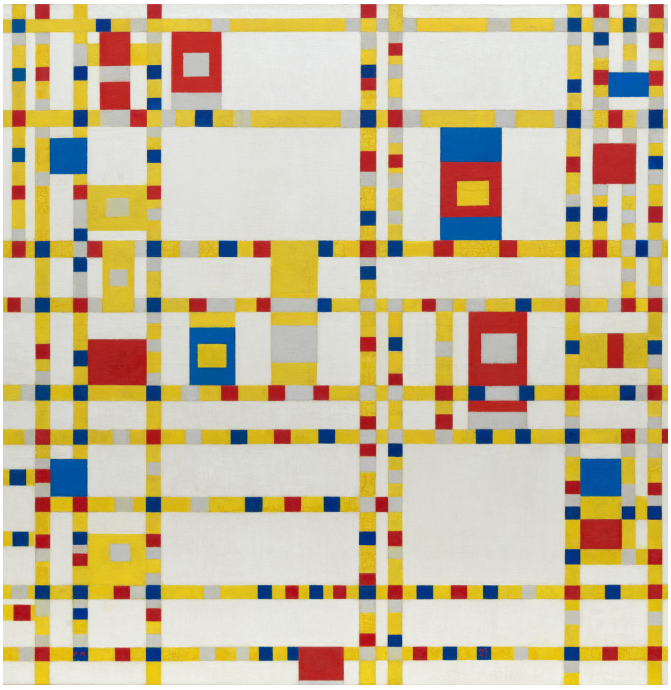
The CRa instigates design competitions as part of the research by design. With those, not only winners are selected, but also a community of people that were client or participant in these competitions. Thus, bringing the ideas forward to a society to work with. Examples of these competitions are: housing for refugees, new forms of living, care, the agricultural transition (new deals for farmers and citizens) and currently, how to empower city fringes; how can post-war neighborhoods and their landscapes fringes more attractive and up to date.

The red line of the story of the CRa is the need a new chapter of Dutch spatial planning. Dutch spatial planning was very much founded at TU Delft, by, amongst others, the founders of the CIAM movement[3], of which architect and urban planner Cornelis van Eesteren was one of the founders, together with his colleague Le Corbusier. Van Eesteren also was

1 https://english.collegevanrijksadviseurs.nl

2 https://www.collegevanrijksadviseurs.nl/adviezen-publicaties/publicatie/2019/11/18/panorama-nederland-engels

3 CIAM. The Congrès internationaux d'architecture moderne (International Congresses of Modern Architecture) was founded in 1928 and disbanded in 1959. It was responsible for a series of congresses around the world by the most prominent architects of the time, with the objective of spreading the principles of the Modern Movement focusing in all the main domains of architecture (landscape, urbanism, industrial design, and many others).



02

02 Piet Mondriaan. Broadway Boogie Woogie. 1942-43 MoMA

03a

03a Katwijk, parking garage in dune

one of the founding fathers of De Stijl, of which painter Mondrian was one of the leading partners. Not by coincidence, the classic Mondriaan paintings (see figure 02) and the classic plans of van Eesteren look very similar. They both have mono-colored fields; in terms of Van Eesteren these were meant to be mono-functional areas with only a residential function or a work function or another type of function. It was about avoiding conflicts between functions. The last Mondriaan paintings, made in New York, are a much more apt metaphor for the contemporary challenges that our cities face. This Victory Boogie Woogie shows a much more dynamic mix of colors in small patches.

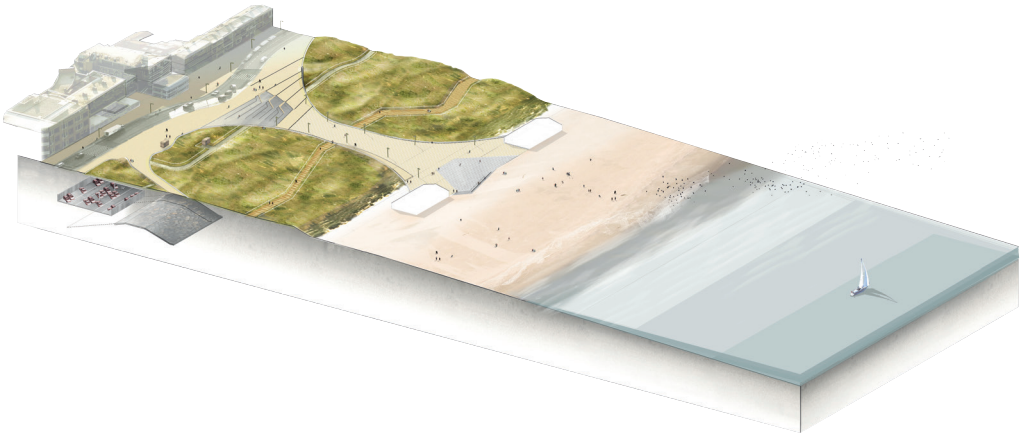
In the days when van Eesteren was wearing his white lab coat and thought about what was best for the future of the Netherlands, they did scientific surveys on how the Netherlands could house for example twenty million people. In their Research by Design they worked on three options for a patchwork region: have bigger cities, allow urban sprawl, or opt for a polycentric region. In the end, all experts thought this polycentric model was the best and they spread it out like peanut butter across The Netherlands. They called it 'gebundelde deconcentratie', concentrated de-concentration, but it is state-driven sub-urbanization. Those were the days they thought of the Netherlands as being a world champion of urban planning, which is no longer the case by far. Because both as urban designers and as politicians, currently there is no room for others to add their ideas and their initiatives. And in fact, politicians and designers have to acknowledge that a lot of times they have been wrong, and society or the economy or the climate or nature actually knew much better than the politicians and designers did. So maybe there is no longer a need to make plans that are blueprints, but plans that are actually leaving room for all these other powers in society to incorporate ideas. One example is the city of Amsterdam where urban planners were trying to redevelop the IJ-banks at the north of the city center to become an economic heart. But then the ABN Amro Bank decided that the south side of the city, situated between the city center and the airport, was a much better place for its headquarters. And after five years,

the municipality gave in, the national government gave in and all agreed that the south side was a better place. Now it is called De Zuidas and it is the Central Business District of the Netherlands.

The Netherlands actually faces big challenges. Looking at the newspapers and the public debates, it looks very negative: all change is received as a kind of threat. The CRa thinks that is a missed opportunity. Change is in fact an opportunity to adapt to new circumstances and to pursue evolution. Big challenges the Netherlands faces are identified: to reach the Paris Climate goals, to build one million homes in the next two decades, to adapt to climate change in order to keep our feet dry and our mind cool. However, these very big issues are not of daily concern of our citizens and companies. These issues are perceived as something important but not taken into action.

The CRa thinks that there is the need for a frame to motivate people. Hence Panorama NL, a perspective of the Netherlands in two or three decades, that people can identify with and desire to be part of. One that they look forward to; a Netherlands that they want to work on, that they want to be a part of, that they dream of. Then, all these big challenges from before probably work more as an engine behind the new Netherlands. And it is actually that panorama that we have painted: how the Netherlands can change in the next generation. It is a very optimistic story. A story that shows that the Netherlands can remain recognizable as the country as we know it; yet it will operate or function completely different as we were used to. That is the Panorama NL, showing how big challenges can be used to make the Netherlands richer. That means more diverse, but also more prosperous. It should be more coherent, both socially as through mobility networks, and much 'schoner', which means both cleaner and more beautiful.

This Panorama was created with a small team consisting of West8 landscape architects and urbanists and Vereniging Deltametropool. Four big challenges were identified: climate adaptation, energy transition, one million homes and to transform the agricultural system into a much more sustainable way. A system that is good for the farmer and good for the landscape as a new deal between farmers and society. These four challenges cannot be addressed separately, as was done traditionally, but together. The best level to do so is at the level of the region. That is the level on which urban systems function and where three governmental layers (national government, the provinces and the municipalities) meet and



03b

03b Katwijk, parking garage and dike in dune; image by OKRA Landschapsarchitecten

(should) make deals. At this level, it can be explained to citizens that some of the measures are maybe not so nice, but that they can be balanced out with other measures that make it much more attractive. Challenges can be used to make each region (thirty in total) stand out a little bit from the others. Instead of that the regions would start to look more like each other, they can be much more different, based on their landscape features, their cultural history, their economic profile and the cocktail of challenges they face. Differences are not contradictions. It is also a way to address the division that seems to be buried in the Dutch society, between the gilets jaunes, the yellow jerseys, and let's say the elite of white wine drinking people, it is actually part of an answer to minimizing social segregation. Because these regions offer on the one hand, a kind of safe, recognizable home region, their traditions are still there and it is kind of a protection against the big world outside. And yet, for all the cosmopolitans there is also this palette of very different regions on offer from which one can 'shop' for all the different qualities amongst them. The dream is that all of us will sometimes wear a yellow jersey to protest all the movements and drink a white wine from time to time. This is also a power to use these new challenges to make what exists now much better.

The CIAM movement really saw that the dark medieval city was chaos, a place to be avoided, which needed to be erased and replaced by something completely new. This promise is no longer true, we are at the end of 'new is better'. We have to shift from the modernistic Tabula Rasa to Tabula Scripta[4], we have to write on top of what is already there. And that's not just a design statement; it is a social and ecological statement as well.

Johanna Westerdijk was the first female professor in the Netherlands. She was studying fungi, and, after a career-long study, her main observation was that a boring and monotonous life even kills a fungus[5]. This is not only true for a fungus, but it is also true for mono-functional urban areas too, like a residential neighborhood or a business district or a recreational forest area. If they are only good at one thing and the world changes,

4 http://tabulascripta.nl

5 Kerling, L., Ten Houten, J., & De Bruin-Brink, G. (1986). Johanna Westerdijk. Pioneer Leader in Plant Pathology. In: Ann. Rev. Phytopathol. 24:33-41. See also: https://www.uu.nl/en/organisation/utrecht-university-hall/j-westerdijk-room-johanna-westerdijk-the-phytopathologist

04 Panorama NL

they are dead. Urban areas need to be good at multiple things. David Rusk studied from a social perspective why some American social groups were able to make a social career and others were not[6]. He concluded: it is not a problem if your parents have a low income or low education. It becomes a problem if none of the kids in your school class, or the kids you play with in the street have parents with a different perspective in life. If you never meet other walks of life, then the idea of climbing the social ladder becomes like a Hollywood movie. It's a fairy tale, not a prospect for you.

6 Rusk, David. 1993. Cities Without Suburbs, Baltimore: Johns Hopkins University Press/The Woodrow Wilson Center Press

7 https://www.collegevanrijksadviseurs.nl/projecten/panorama-nederland

THE DESIGN OF 'SOFT POWER'

The Panorama NL is about storytelling, about how to offer a positive perspective in society to everyone and Panorama NL does just that. It is a book and it is also an app, through the app store, in which you can see literally 360-degree panorama at eye level[7] . It is one big photoshopped collage of the Netherlands, in which you see recognizable elements knitted together without being able to pinpoint where exactly it is. The CRa did a promotion tour with the Panorama NL with lectures and an exhibition: a big panorama with a diagonal of eight meters and a small one, with a four meters diagonal (see figure 04). It toured around the Netherlands to tell the story and regions organized a debate about the future of their region within this panorama. The panorama was copied by the regions and made specific, for certain topics, for certain companies. The regions are also struggling to formulate their own vision. Panorama NL was a way to promote this type of thinking into stimulating debate and complementary to design and design thinking tools to get our ideas across.

While creating Panorama NL, CRa found out that the national government was not interested in the housing question, the building of one million homes. It was considered as a local issue and not of national importance. CRa developed a tool that showed its impact on the national budget and how it was about national goals. It consists of a rainbow of societal values that were important to the national government and in which they had a financial stake. It showed that in the Amsterdam region only, one urbanization model versus the other made a difference of € 10 billion on national level. Suddenly the politicians and civil servants were very interested in the regional housing question. Because they realized they would have to pay for extra infrastructure, or for extra energy, or for support in some large residential neighbourhoods that were getting weaker. And so at last they concluded that they want to collaborate with these regions on their housing tasks. This shows how through design thinking you are able to incorporate finance and get ideas across, get attention. Without the language of finance, it would never have worked. It was also linked it to other issues like health care, which today is number on eon the agenda.

Another collaboration of CRa with the largest five cities in the Netherlands (G5) was about how to develop mixed-use areas in a high population density. The argument to why mixed-use development is good was made to explain better the concept: it intensifies the use of space, it reduces mobility, et cetera. A very simple tool was created to help the municipalities to mix functions. One of the conclusions was: don't mix at the level of a building; mix at the level of a building block. Plan residential buildings next to office buildings, to hotels and to schools and don't mix them like

New York's Downtown Athletic Club, stacked on top of each other - that is very costly, and does not add many extra qualities. It is better to mix where people walk and meet each other at ground floor and at street level. The best way to make mixed-use neighborhoods is to - make a diverse plinth. The first layer can have multiple functions without disturbing the vertical infrastructure of the building and without disturbing ownership. To make it successful this plinth needs to be programmed with morning, afternoon and evening program, in order to make it lively always.

The same tool was used to reinvent Van Eesteren and Mondriaan with his Victory Boogie Woogie. Like Mondriaan being inspired by Manhattan, mixing functions must make use of existing, present different circumstances. It is a kind of zoning, but it is not zoning based on function, but zoning based on quality. We called it in Dutch 'Reuring, Ruis en Rust' and in English 'Buzz, Fuzz and Calm'. The Buzz forms the lively part, there are bars, theatres and a high level of services. On top there are offices and apartments. Around the corner, the Calm zone is situated, a quiet and peaceful green area with apartments for living and offices for working. The noise here is of a lower level. The Fuzz zone has light industry, logistics and unique housing types with a for example a music studio or food ateliers. This is the more experimental and innovative part of town. All these three zones come together in what is called a 'framework plan'. The zones follow the reinvented Van Eesteren scheme, not based on functions, but on qualities. With in each zone another maximum level of hindrance and danger. This is currently tested in a few cities and the plan is to make this happen.

Panorama NL paints a picture of what we should do and why we should do it. But the next question is: how do we actually do it?'

This led to the latest competition called 'Panorama Lokaal'[8] (the local panorama), which looks into the post-war residential neighborhoods at a city's fringe, facing the countryside. These are places mostly built in the 60s, 70s, and 80s where a lot of baby boomers still live quite happily. These areas all are the same: row houses, lots of green, not very high quality. They are getting rundown and are quite monotonous.

The municipalities were challenged to think about how the global and national challenges could help to improve these areas qualitatively. 'How can the countryside help suburbs and how can the suburbs help the countryside? Think about things like loneliness and rejuvenation in these neighborhoods. How about the identity and orientation of both the landscape and these suburbs? How about the biodiversity in the countryside? How can we improve?' The competition is inviting municipalities in coalition with housing corporations, Water Authorities, countryside organizations, or local citizens group. Seven sites were chosen nicely spread throughout the country and in a way that they represented different eras of the Dutch history of urbanization. For each site a more specific question was formulated which was then set up as a design competition. From the 147 entries we selected three winning teams per site to continue on the assignment. The 21 teams are building up experience in addressing all these issues in this way, can be hired throughout the Netherlands. Other municipalities can call on these seven cities to share their experience, explain what they have learned, the do's and the don'ts. That really is the

8 https://panoramalokaal.nl/prijsvraag/english+summary/

purpose of the competition: it is not only about the best plan, but also that different disciplines work together in these new proposals, which are not only spatially oriented.

To think about the future of a country or a region, is also to think about how to govern it, how to organize it. Dutch national government had a tradition to work top down. The national government gave the orders but in the past 20 years, the intention of the national government was to not be at the table at all. They went to a planning strategy that invited input from local and private partners: in Dutch called 'uitnodigings planologie'. But by now, the challenges are so big that national government actually needs to return to the table, and start to collaborate with the other stakeholders. This is a new situation again: national government is no more just providing funding but also needs to participate with a vision, be able to organize partnerships. The most important scale to operate on is the regional scale. That is not the scale for local authorities only; the national government needs to represent the national interest there as well. For spatial reasons, the national government has to look for example for collaboration with neighboring countries on how to use the North Sea for renewable energy, how do deal with climate change, make mobility networks work. And, of course, the national government needs to collaborate in projects and they really tend to forget about it. But four recent projects show that the national government can still be very successful: A2 tunnel Maastricht[9], Room for the River[10], Rotterdam Centraal train station[11] and Dune Parking Garage in Katwijk[11] (see figures 03a and 03b). All of them address very different topics. However, most knowledge around these projects is lost in national government bodies, so they need to be reminded that they were there and that they can still do it.

This also means that we need to educate people differently; at the ministry at the national government level, but also at the university. Training should aim for T-shaped skills: a specialist in their profession and to represent it, and to know all about it, but they also need to be able to communicate their knowledge with people from totally different backgrounds, like economists or sociologists; or laymen or politicians. That is the way we approach Dutch designed soft power.

9 https://a2maastricht.nl/en
10 https://youtu.be/slmkG93SH3Q
11 https://www.archdaily.com/588218/rotterdam-central-station-benthem-crouwel-architects-mvsa-meyer-en-van-schooten-architecten-and-west-8
12 https://www.flooddefences.org/katwijk-aan-zee.html https://www.archdaily.com/791812/underground-parking-katwijk-aan-zee-royal-haskoningdhv

Dictionary

Delta

On October 13, 2012, the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite captured this nighttime view of the Nile River Valley and Delta. This image is from the VIIRS "day-night band," which detects light in a range of wavelengths from green to near-infrared and uses filtering techniques to observe signals such as gas flares, auroras, wildfires, city lights, and reflected moonlight.. Away from the lights, however, land and water appear uniformly black. This image was acquired near the time of the new Moon, and little moonlight was available to brighten land and water surfaces. NASA Earth Observatory image by Jesse Allen and Robert Simmon.

MaartenJan Hoekstra

Delta (noun) /'deltə/ [1]
- the fourth letter of the Greek alphabet
- a change in a figure or amount
- an area of low, flat land, sometimes shaped approximately like a triangle, where a river divides into several smaller rivers before flowing into the sea.

The popular history behind the word *delta* in the geographical sense starts with Hēródotos. This famous ancient Greek historian used the word *Delta* fourteen times in his *Histories* from 430 before Christ, referring to the mouth of the river Nile. Of course this was no coincidence: seen from Greece the triangular shape of the Nile mouth resembles the Greek capital letter with the same name, Δ.

Unfortunately, there is no evidence that Hēródotos coined the word and it is more likely that it was already used in this sense a century earlier.2 It is even possible that the seafaring people of the Phoenicians already referred to the Nile Delta with the fourth letter of their alphabet. This *dālet* looked more or less the same and it was based on the form of its original meaning, 'tent door'. Later, the Greek letter *delta* was derived from it.

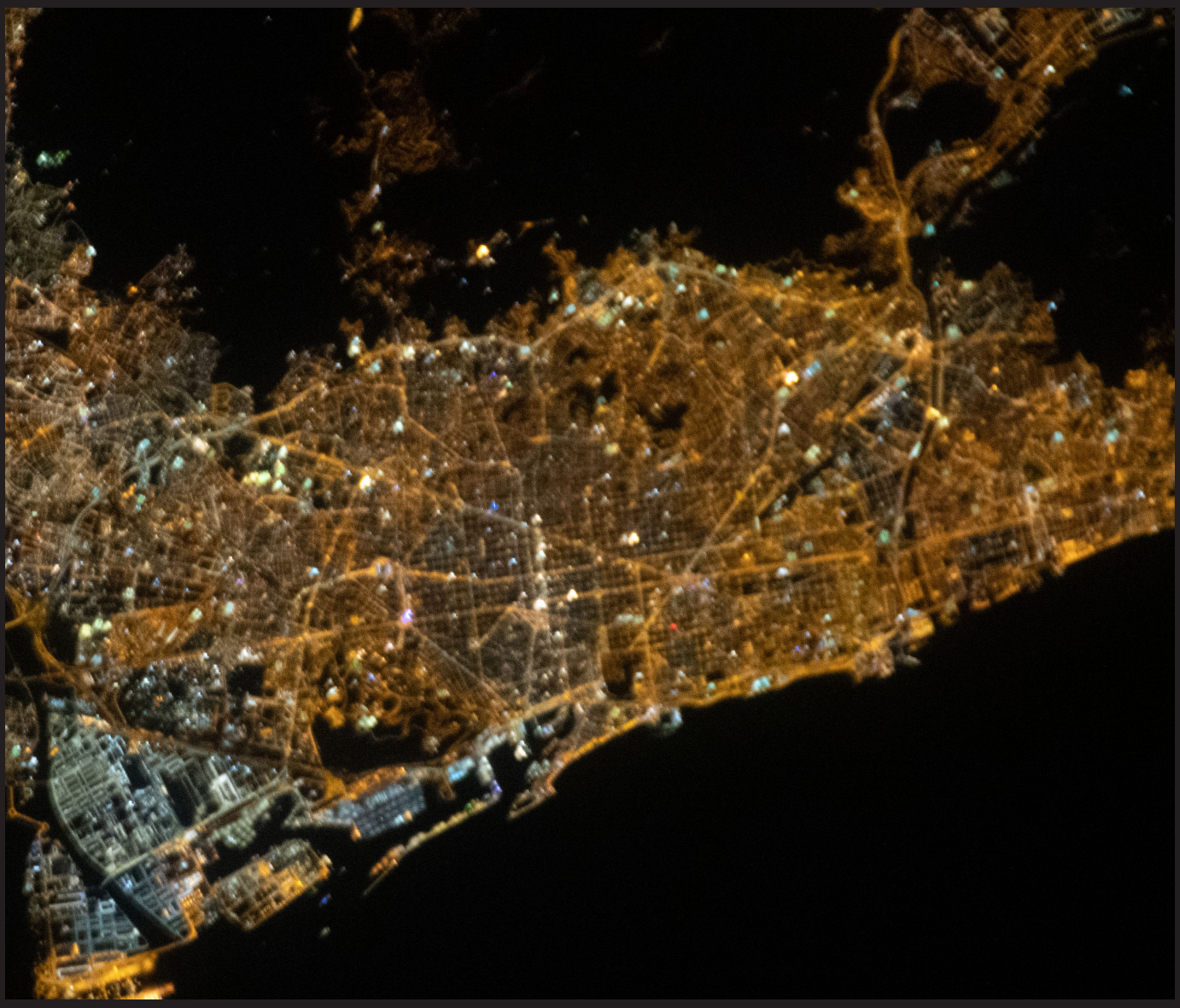
After Antiquity, the Greek name for the Nile Delta stayed in use and spread across the globe. It was used in English for the first time in 1555. Not earlier than 1790 the word was used for delta areas other than the Nile, and this English broadening of meaning has been taken over internationally since then.

And for a good reason: when whichever river flows through lowlands to the sea, its speed decreases and sediment is causing it to look for smaller branches to the open water, as such forming a more or less triangular shape. This physical land form is named after a deltoid character, that itself is derived from a character that is based on a physical tent door. Conclusion: full circle.

BIBLIOGRAPHY

1 Cambridge Dictionary, © Cambridge University Press 2020.
2 Cerola, F. (1966). Delta as a Geographical Concept in Greek Literature. Isis, 57 (3), 385-388.

Urbanism



This nighttime view of Barcelona, on the coast of the Balearic Sea, was taken from the International Space Station as it orbited above the east coast of the Spain. Image by NASA, September 15, 2020.

MaartenJan Hoekstra

Urbanism (noun) /ɜ..bən.ɪ.zəm/ [1]
- the type of life that is typical of cities and towns
- the process by which more and more people leave the countryside to live in cities and towns

In 1867 the Spanish engineer-architect Ildefonso Cerdá published his *Teoría general de la urbanización* or 'General Theory of Urbanisation', in order to support his famous Eixample ('expansion') design for Barcelona. In this treaty he coined two new words, namely the *urbanización* from the title, as well as the term *urbanismo*, for the new, autonomous design activity and scientific discipline focused on the spatial organization of cities. Cerdá based both neologisms on the Spanish word *urbe*, that stems from the Latin word *urbs*, 'city'. In the disciplinary word he combined this with the suffix *-ismo*. Just as the English *-ism*, this indicates a certain practice, system or doctrine. It is based on Greek *-ismós*, that originally formed nouns from verbs.

The Spanish term was translated into the cognate languages Italian and French (as *urbanismo* and *urbanisme*), but in the Anglosphere *urbanism* did not gain a foothold in the nineteenth century yet. Instead, the term *town planning* came up, as can be seen in the foundation of the British *Garden Cities and Town Planning Association* in 1902 and Raymond Unwin's famous book *Town Planning in Practice* from 1909.

While the word *planning* might suggest a more strategic focus, the original ideas behind it did include design, beautification and wellbeing of inhabitants. This was also influenced by the German tradition of *Städtebau*, that started in 1889 with Camillo Sitte's Die *Städtebau nach seinen künstlerischen Grundsätzen,* 'City Building according to Artistic Principles', which in Dutch led to the loan translation *stedenbouw.*

The international use of the word *urbanism* got a new impulse with the publication of Le Corbusier's *Urbanisme* in 1925 and the Declaration of La Sarraz in 1928, that started the CIAM, *Congrès Internationaux d'Architecture Moderne*, and of which the second chapter was called "*Urbanisme*".

Since then the word urbanism has been used frequently in English, but often more in a research sense than according to the original Spanish meaning that included planning and design; science and art. This difference might be caused by the English tradition of town *planning*, or by the modernist bias on functionalism. However, in The Netherlands there has always been a strong emphasis on the "unity" of design and research, of vision and knowledge, as stated in the inaugural lecture of the first Delft professor in Urbanism, Theodoor Karel van Lohuizen, in 1948.2

BIBLIOGRAPHY

1 Cambridge Dictionary. © Cambridge University Press 2020.
2 Van Lohuizen, Th.K. (1948). De eenheid van het stedenbouwkundige werk. Delft.

JDU
Journal of Delta Urbanism

JDU is a project by Delta Urbanism Research Group
and DIMI Delft Deltas, Infrastructure and Mobility Initiative
Delft University of Technology

Graphic Layout
bruno, Venice (Italy)

Typefaces
Union, Radim Peško, 2006
JJannon, François Rappo, 2019

Publisher
TU Delft OPEN
https://www.tudelft.nl/library/openpublishing

Subscription and Printing on Demand
Open access journal: available subscription on the journal website
For subscriptions and any further information: JDU-BK@tudelft.nl
Printing on demand will be available from January 2021

Frequency: 2 volumes per year

Publication Funding
TUDelft Delta, Infrastructure and Mobility Initiative

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N.1 / Premises
Fall / Winter 2020

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All published contributions are submitted to a Blind Peer
Review process except for the sections Dialogues and Dictionary.

ISSN: 2666-7851
p-ISSN 2667-3487

Delta Urbanism is a line of work in which flood protection, ecosystems restoration, soil regeneration and water management strategies are integrated with urban design, landscape architecture and spatial planning.

Founded on the interdisciplinary approach, in which design and engineering disciplines activate innovation in design, technology and governance, Delta Urbanism has international impact as it tackles global issues of the environmental crisis. The Delta Urbanism discourse is characterised by a body of knowledge organised into four research premises, which emphasise the agency of design and technology and the development of specific methods of analysis, design, visualisation and interdisciplinary work: ‘Land-Water-Atmosphere Continuum’, ‘Drawing the Delta’, ‘Reversed Engineering with Nature’, and ‘Extremes’.

JDU is published twice a year, in spring and autumn. Submissions can be sent in individually; also, guest editors are invited to present specific topics to be published in special editions. We welcome your academic research papers, column style dialogue contributions, practice experiences and design project studies.

Delta Urbanism
TU Delft Interdisciplinary Research Program
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