Liquid, Solid, and Gas

Axioms for Aqueous Landscapes in Transition

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Extreme weather events, droughts, floods, shifts in precipitation and temperature patterns, melting glaciers, sea-level rise, water salinization, and more generally, changes in the water cycle remind us that the climate crisis is mostly a water crisis. Perhaps even more serious is a crisis of imagination connected with thought and with creative, far-sighted action able to combine the visionary and the pragmatic. A response to these two crises can be provided by the disciplines of landscape architecture: these have always featured a plural, collective approach that comprises or originates from living systems and natural forces, on the involvement of human and nonhuman communities in the design process, and the inclusion of the time variable in future plans—without neglecting the necessary flexibility of creative and pragmatic thinking. How can landscape design and different forms of collaboration open new doors to face climate and water challenges? What hopes can spring from collective design in its broader meaning?

This book sets out notions and ideas on water landscapes and (co)designed practices, identifying what hopeful routes might be taken for the three states of aqueous landscapes in transition—liquid, solid, and gas. The chapters show different scales and levels of design and collaborative practices: from large and governmental projects to small bottom-up interventions; from creative collaboration among designers to traditional community design; from participatory processes to nature as a co-designer for tackling the climate crisis. People, animals, plants, water, ice, fog, clouds, wind, sand, and rocks—all contribute to the cosmos' landscape symphony, and designing together can become a seed of hope to listen and embrace the Earth's climate changes.

Laura Cipriani is an assistant professor of landscape architecture at Delft University of Technology. Her current research addresses climate change issues, starting from the materiality of *water* and *soil*, and adopting (co)design approaches. Over the last decade, she has taught at Venice University IUAV, Politecnico di Milano, National University Singapore, Venice International University, and the University of Padua. She holds bachelor's and master's degrees in Architecture (Hons) from IUAV, a Master's in Design Studies (Hons) from Harvard Design School (2004), and a Ph.D. in Landscape Urbanism from IUAV. In 2008, Laura founded Superlandscape, a landscape and urban design firm.

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Laura Cipriani | Editor

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Edited by Laura Cipriani

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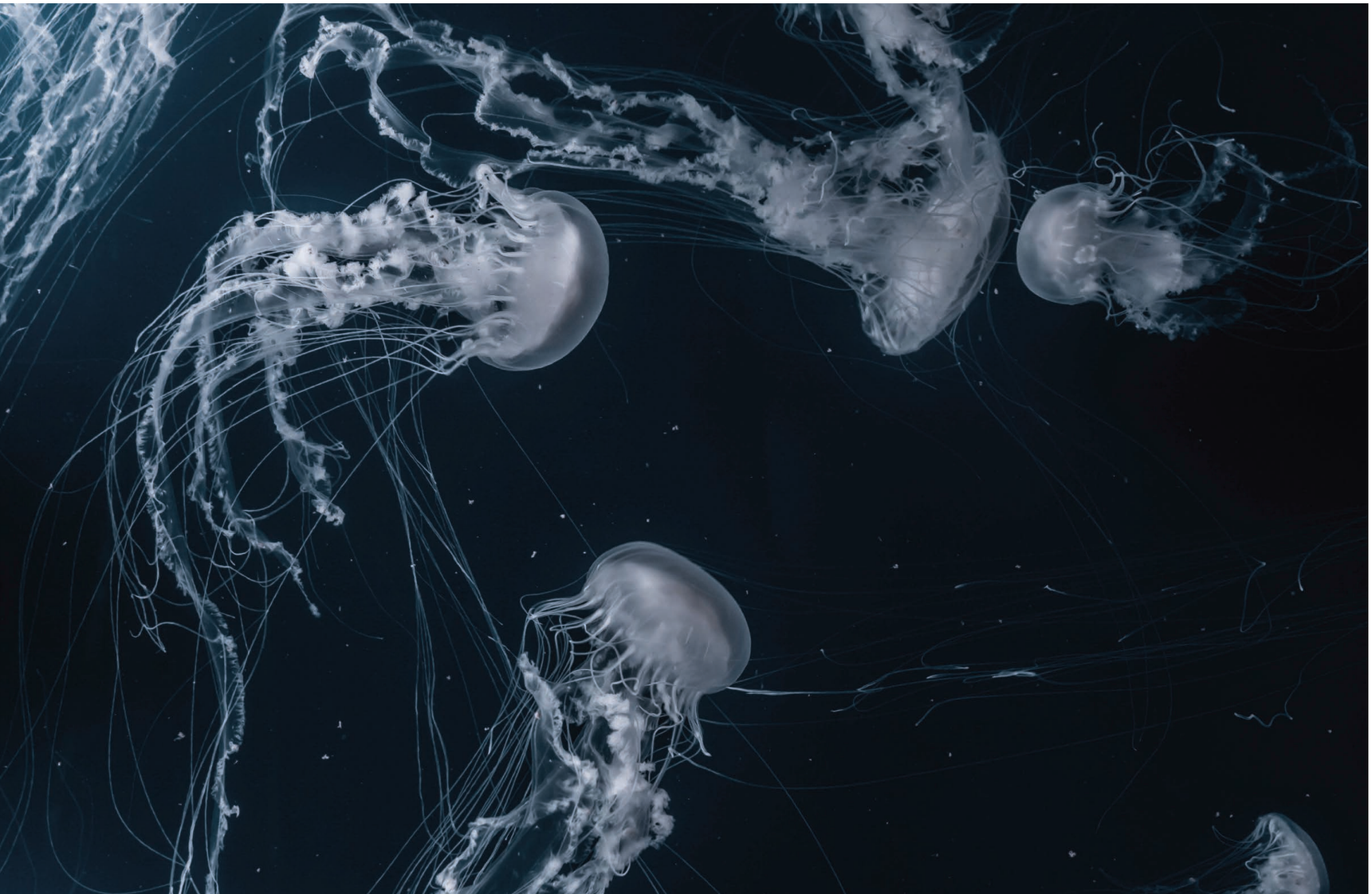
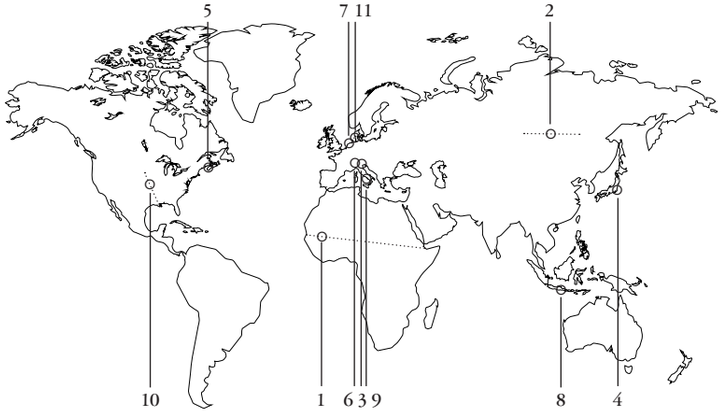


Introduction

1 | Liquid, Solid, and Gas
Axioms for Aqueous Landscapes in Transition

Laura Cipriani



1 | **Great Green Wall**
Location
From Senegal | Africa
To Gibuti | Africa
Coordinates
From 14° 28’ 30.219” N | 14° 27’ 10.66” O
To 11° 48’ 52.548” N | 42° 50’ 43.101” E

2 | **Three-North Shelter Forest Program**
Location
From Xinjiang | China | Asia
To West Inner Mongolia | China | Asia
Coordinates
From 42° 28’ 49.783” N | 85° 27’ 48.047” E
To 43° 14’ 39.567” N | 114 ° 19’ 30.599” E

3 | **Woods of San Marco**
Location
Cansiglio Forest | Trento | Italy | Europe
Coordinates
46° 3’ 48.534” N | 12° 24’ 25.815” E

4 | **Morino Project**
Location
Iwanuma | Prefecture of Miyagi | Japan | Asia
Coordinates
38° 12’ 16.768” N | 140° 58’ 26.168” E

5 | **Living Breakwaters**
Location
Tottenville | Staten Island | New York | USA | North America
Coordinates
40° 30’ 45.966” N | 74° 15’ 7.093” O

6 | **Aire River Project**
Location
Geneva | Switzerland | Europe
Coordinates
46° 10’ 24” N | 6° 05’ 03” E

7 | **Sand Engine**
Location
Monster | The Netherlands | Europe
Coordinates
52° 3’ 15.084” N | 4° 11’ 22.181” E

8 | **EcoShape ‘Building with Nature Indonesia’**
Location
Demak | Northern Java | Indonesia | Asia
Coordinates
6° 54’ 14.097” S | 110° 30’ 46.453” E

9 | **Dulcis Pompeia Palus**
Location
Stabian Plain | Pompeii | Italy
Coordinates
40° 43’ 41.179” N | 14° 28’ 44.298” E

10 | **Mississippi River**
Location
From Itasca Lake | Minnesota | USA | North America
To Pilottown, Plaquemines Parish | Louisiana | USA | North America
Coordinates
From 48° 56’ 29.292” N | 95° 24’ 2.771” O
To 29° 9’ 49.445” N | 89° 15’ 7.636” O

11 | **Wadden Sea**
Location
From Den Helder | The Netherlands | Europe
To Mosevrå | Denmark | Europe
Coordinates
From 52° 57’ 21.669” N | 4° 43’ 39.805” E
To 55° 35’ 39.718” N | 8° 15’ 12.741” E

Landscape design is the product of a plural, collective symphony that involves or originates from living systems and natural forces. From hydrologist to botanist, fisherman to farmer, swallow to fish, rain to wind, all of Earth’s systems constantly draw landscapes. The actors involved in the collaborative dance of the cosmos incessantly design landscapes within a complex and often indecipherable plan.
How can landscape design and different forms of collaboration open new doors to tackle the water and climate crises? What hopes can spring from collective design in its broader meaning? This introductory chapter sets out a number of ‘axioms,’ observations, notions, and ideas on landscapes, the water and climate crises, and (co)design, identifying what hopeful routes might be taken for the three states of aqueous landscapes in transition—liquid, solid, and gas.
People, animals, plants, water, ice, fog, wind, sand, and rocks—all contribute to the cosmos’ landscape symphony and designing together can become a seed of hope to listen and embrace the Earth’s climatic changes.

Crisis and Hope: In Search of a Collaborative Design

We are currently living in a state of crisis identifiable in many parts of the world as economic, environmental, climate-related, political, social, and ethical, with various shades and nuances. We should be prompted by all of these multiple, planetary, and systemic crises to take the necessary and material transformative actions.

Crisis comes from the Greek *krino*, which literally means to *separate*, as in the agricultural operation of separating the wheat from the chaff, the good from the bad, and the seed from the waste. In effect, this is why every crisis brings with it the opportunity for change. As implied by its semantic meaning, a crisis involves a judgment as to what should be kept (as good) and what should be discarded (as detrimental). It represents a turning point, without which the *status quo* would remain unchallenged. Thus, the seed of a crisis is always a source of hope as well.

With various etymological roots, the word *hope* also includes the concept of landscape. The Old English *hōp* indicates a *valley*, especially the upper end of a narrow mountain valley when it is nearly encircled by smooth, green slopes. In Scottish, the term refers to a small bay, an entrance, or a refuge. Landing from the sea or reaching the high parts of mountains induces a feeling of hope in man. The Indo-European root of *hope* (*speh-*) refers to *moving toward a destination* and, therefore, changing direction toward a probable and desirable future—a confident optimism of one's destiny and that of the world. Hope has been linked to the concept of landscape, to an active hope that sets man and natural forces in motion.

Fifty years have passed since *The Limits to Growth* (Meadows et al, 1972), one of the first studies on the various crises that the planet would soon have to face, was published by the Club of Rome. In 1972, a group of scientists from the Massachusetts Institute of Technology launched an appeal to the world after completing studies commissioned by the visionary industrialist Aurelio Peccei that called for a change to the existing model of growth. There is a clear awareness that every crisis—whatever its nature—brings with it a series of multiple planetary crises, somewhat in the manner of a chain reaction. The terms *crisis* and *hope* resound in the text as a warning to society that the world economy should be oriented toward a quest for balance rather than for growth:

> 'Our goal was to provide warnings of potential world *crisis* if these trends are allowed to continue, and thus offer an opportunity to make changes in our political, economic, and social systems to ensure that these *crises* do not take place.'
>
> (Meadows et al, 1972, p. 186)

There is a common denominator to the crises identified, namely the finiteness of natural systems:

> 'The message of this book is urgent and sobering: The Earth's interlocking resources—the global system of nature in which we all live—probably cannot support present rates of economic and population growth much beyond the year 2100, if that long, even with advanced technology. (…) The book contains a message of *hope*, as well: Man can create a society in which he can live indefinitely on Earth if he imposes limits on himself and his production of material goods to achieve a state of global equilibrium with population and production in carefully selected balance.'
>
> (Meadows et al, 1972, p. 210)

Among the many current crises, I see two as being particularly significant. The first, which concerns the climate, is well known and we are now seeing how serious the outlook has become. Extreme events, droughts, floods, shifts in precipitation and temperature patterns, melting glaciers, sea level rise, water salinization, and general changes in the water cycle remind us that the climate crisis is mostly a water crisis. The second—and perhaps even more serious—is a crisis of imagination that is connected with thoughts and creative, far-sighted actions capable of combining the visionary and the pragmatic. Notably, design and designers seem less relevant in the climate discourse. Most books and publications outside the design realm focus on the hazards presented by the climate crisis, rather than on the opportunities it might offer us. Most academic publications prefer to quantify and define the problem, proposing standardized solutions and toolkits rather than offering site-based designs for climate adaptation and mitigation that allow us to (re) think the territory in all its social, economic, and aesthetic dimensions. In this sense, the crisis of imagination relates to the climate crisis.

In my estimation, a response to these two crises can be provided by the discipline of landscape architecture: This has always featured an interdisciplinary approach focusing on water, environmental and ecological issues, the involvement of the community in the design process, and the inclusion of the *time* variable in future plans—yet without neglecting the necessary flexibility of creative and pragmatic thinking.

Taking up these themes, landscape architect and academic Richard Weller published his *Atlas for the End of the World* (Weller, Hoch and Huang, 2017a)—a world map offering a cartographic view of the various planetary-scale crises. Increasing urbanization in the planet's most at-risk bioregions is censused in 38 'hot points of biodiversity,' indicating how future urban expansion across these areas conflicts with natural elements and threatens endangered species. The reporting of systemic crises—water-related, ecological, urban, economic, and social—is presented together with the notion that only wide-ranging and large-scale planning design can effectively *save* the planet. Weller proposed establishing two green wedges

around the Earth's circumference, consisting of forests and protected areas: The first on a longitudinal axis extending from North to South America; the second on a transverse axis extending from Europe to Australia via Central and Southeast Asia. Could the landscape indeed become an instrument of change through hope and action? Moreover, could it represent a key factor in gradually overcoming our various planetary crises?

The third term I must refer to is *(co)design* (or *collaborative design*) to highlight landscape design as the product of a plural, collective symphony that involves or originates from living systems and natural forces. From hydrologist to botanist, fisherman to farmer, swallow to fish, rain to wind, all of Earth's systems constantly draw landscapes. The actors involved in the collaborative dance of the cosmos incessantly design landscapes within a complex and often indecipherable plan. Their actions are the conscious products of a will and sometimes the unconscious result of a need, an adaptation, or a chance. Therefore, thinking in (co)design terms means expanding humans' gaze and involves living and non-living things, such as people, animals, plants, water, ice, fog, wind, sand, and rocks, which contribute to the cosmos' landscape symphony. It is a way to feel and catch different sensibilities, starting from different scales: The human and the non-human, the microscopic, and the overall vision.

In the context of collective complex systems, physicist Giorgio Parisi, when studying the flight of flocks (Parisi, 2021), attempted to explain how collective behaviors are derived from the behavior of an individual (e.g., a single bird), which can be interpreted using the laws of physics. Each flock member can communicate to move coherently, producing a single, collective, and plural entity.

> 'At sunset, we see the flocks forming phantasmagorical images; thousands of dancing black spots that stand out against a sky of iridescent colors. We see them all moving together without bumping into each other or dispersing while overcoming obstacles, distancing themselves, and then regrouping, continually reconfiguring their spatial arrangement as if there were an orchestra conductor giving orders that everyone follows. We can spend an indefinite amount of time watching them; the show is always renewed in different and unexpected forms. Sometimes, even in the face of this pure beauty, the professional deformation of a scientist peeps out, and many questions whirl in his head. Is there an orchestra conductor, or is the collective behavior self-organized?'
>
> (Parisi, 2021, p. 7)

The beauty and technique of this natural performance remind us that (co)design requires both of these factors, especially in times of crisis. In the concluding chapter of this book, it is noted that Knox and Holmes (see Chapter 15) referred to the term 'choreography' since the landscape forces can

simultaneously design a technical and poetic composition in constructing landscapes.

How can landscape design and different forms of collaboration open new doors to tackle the water and climate crises? The chapters of this book show different scales and levels of design and collaborative water practices: From large governmental projects to small bottom-up interventions; from creative collaboration among designers to traditional community design; from participatory processes to using nature as a (co)designer for tackling the climate crisis. Collaborative design is vital in addressing the climate and water crises, often arising in a state of emergency. Although collective practices do not always result in success, we must remind ourselves that only cooperative and synergic actions can respond to these issues.

Therefore, this book brings together a series of landscape projects concerning water and climate change deriving from the hope of a (co)design shared by the different human and non-human forms involved. The projects represent an attempt to gather different voices worldwide: From researchers to design practitioners. The immediate objectives are to gain a perspective on water landscapes and climate change issues, review notable projects and highlight less-known stories on the topic, focus on the site-specificness of each collaborative practice embedding their cultural aspects, and comprehend how designing together can become a seed for hope. The greater objective is spreading the notion of (co)design being necessary when we discuss climate change while orchestrating narrower and broader changes that attempt to listen to the Earth's possibilities.

Axioms for Acqueous Landscapes in Transition

With acknowledgment of and apologies to Pierce Lewis, author of the well-known article 'Axioms of the Landscape: Some Guides to the American Scene' (Lewis, 1976), I must set out a number of 'axioms,' observations, notions, and ideas on landscapes, the water and climate crises, and (co)design. Defining certain axioms that are concerned with uncertainty and change is no doubt a risky undertaking—oxymoronic, almost—but my feeling is that it helps to crystallize certain familiar issues and identify what routes might be taken when discussing aquatic landscapes in the climate crisis.

1 | *Axiom of (Un)Certainty*

Scientific forecasts of the future climate crisis are typified by uncertainty and inconsistency. Consequently, designing or re-designing the landscape must be redefined in terms of timescales, modes, and methods to account for progressive changeability.

We know that over the course of the coming years and decades, sea levels will rise, extreme weather events will become more frequent and intense,

Figure 1.1 | The collective landscape dance of a flock. Photographs by iStock.com/AGD Beukhof.

Figure 1.2 | A herd of sheep from above. The (co)design is a collective movement. Photograph by iStock.com/Coldsnowstorm.

and various parts of the planet will be affected by temperature changes, the increasing recurrence of rainfall and drought cycles, coastal erosion, and subsidence. While there is a shared awareness regarding climate change currently taking place, we do not know when and how intensely it will be manifested in the coming years. Moreover, the datasets available at present indicate that the dynamics of climate change are evolving faster than initially predicted.

Richard Weller provocatively visualized sea level changes at the global scale if the ice caps were to melt in their entirety. This scenario envisions new imaginary geographies of the world: A sea level rise of 80.32 meters will create different coastlines and inland seas, resulting in the disappearance of more than 50 major cities. 'Even if sea level rises only 0.74 meters by 2100, as is conservatively predicted, some 115 million people will likely be displaced and 420,000 km^2 of land will be lost to the encroaching seas' (Weller, Hoch and Huang, 2017b). We are not aware of what will happen. What we are certain of is that we will face an uncertain future.

2 | *Axiom of Inertia*

Any landscape either remains at rest or in motion unless acted upon by an external force that changes this condition.

The principle of inertia, known also as Newton's first law, can be applied perfectly to the sphere of land and landscape. Every system, of whatever nature, has its own threshold of inertia. As Lewis himself also observed, 'people will not change that landscape unless they are under very heavy pressure to do so' (Lewis, 1976, p. 7).

Locally, but no less globally, no courageous and coordinated *action* is being taken on the part of governments and inhabitants to combat the current threat. Although the consequences of the climate crisis are well known, the causes are only partly understood. Groups of cities exchange ideas by networking and launching initiatives, but there is no concerted implementation of effective and targeted solutions on the territorial scale as yet, whether micro or macro.

Indian writer Amitav Ghosh spoke of a *collective blindness* (Ghosh, 2016). As Ghosh sees it, at the heart of the climate crisis lies a crisis of imagination and cultural awareness. If governments keep referring to shorter and shorter timescales (e.g., five years maximum), then local populations will tend—consciously or unconsciously—to deny or ignore changes that have already been partly evident for some time. For example, this blindness is demonstrated by the fact that properties along coastlines or in areas under threat are still being purchased despite knowledge of future risks. Desirable real estate locations such as Venice and its lagoon continue to be growth markets despite the future climate- and water-related uncertainties.

3 | *Axiom of Catastrophe*

'Most major cultural change does not occur gradually, but instead in great sudden historic leaps—commonly provoked by great events like wars, depressions, major inventions and the like. After these leaps, the landscape is likely to look very different than it did before the leap occurred. Inevitably, however, a lot of "pre-leap" landscape will be left lying around, even though its reason for being has disappeared' (Lewis, 1976, p. 8).

With every rigid system, there comes a moment when a lack of agility and resilience causes the entire mechanism to break down; catastrophic failure, no less. In the 1960s, French mathematician René Thom described natural phenomena by expounding what became known as the 'catastrophe theory' (Thom, 1972; 1983). Thom noted that every element of any given system has a behavior predominantly typified by continuity until a radical, sudden, and abrupt external force causes its condition to change. This evolution is accompanied by earthquakes, volcanoes, instabilities of any nature, and even events of limited magnitude. The catastrophic 'leap' is a sudden passage from one state to another, whereby a system assumes a new and irreversible form. This change occurs over a very short period when compared to the time taken by minimal shifts occurring in more stable states.

Small changes can have huge effects. 'Does the Flap of a Butterfly's Wings in Brazil Set Off a Tornado in Texas?' (Lorenz, 1972) is the title of meteorologist Lorenz's 1972 conference on his theory-poetry of the butterfly effect on how a small change in initial conditions can create a different outcome. Lorenz (1963; 1995) theorized the chaos theory in many natural systems, including weather, climate, and fluid flow.

Water's changes in state provide a good example of this. Let's imagine a glass bottle filled with water. Let's put the bottle in a refrigerator. Water remains a liquid in the bottle over a very long period, while on the surface, everything remains unchanged. Then, at a given moment, the water transforms into ice, the pressure of the ice increases, and the glass bottle breaks open with ice and glass shards bursting suddenly and violently, flowing onto the surface, and creating a new landscape in no time at all—completely changing everything that was there previously.

This point is the catastrophe: An event that is disastrous for the previous state of the system but creates the conditions for the development of a new state in which the system reorganizes itself and continues to evolve until the next catastrophic event occurs. Coastal and river structures show similar behaviors. So-called gray infrastructure can harness rivers within channelized systems or defend coastlines using rigid dikes. When the water volume and pressure are too consistent, any barrier inevitably yields. Rather than fighting against nature, it is always better to adapt to nature, leaving room for water both upstream and along the coast. The famous Dutch

project Room for the River (Feddes et al, 2017) is a concrete example of how adaptation must begin in drainage basins by providing adequate space for water in anticipation of extreme events. Thus, the designs of water basins and rivers must include the coast through a series of interventions to mitigate sea erosion, work with coastal profile changes, and sometimes accept an inevitable retreat. Wetlands, dunes, mangrove forests, and coral reefs are the landscape designer's tools, which are used to reduce the intensity of floods and catastrophic events.

4 | *Axiom of Design*

To combat the climate crisis, the design of the landscape is indispensable in order to set in motion a process of action and reaction to occurring phenomena. Every action must be met by an equal and opposite reaction. This 'force' can be represented first and foremost by landscape design and planning. The more that design can be made holistic, the more beneficial the effects will be on the ecological, economic, and social system/ecosystem.

Most of the literature relating to climate change is primarily concerned with investigating and reporting the current problems, postulating possible scenarios, and discussing policies that might be implemented. On the other hand, far less attention has been given to solid planning solutions. Simultaneously, with the main focus on engineering sciences, it seems that the discipline of landscaping is relegated to a role of secondary importance since the 'design,' whatever the scale of intervention, does not appear to constitute the determining variable in planning possible solutions that should not be purely functional but also consider social, environmental, aesthetic, and economic aspects.

In a well-known book by Tomás Maldonado entitled *La Speranza Progettuale* ('The Design Hope') (Maldonado, 1970), the author insisted on the role of design as a tool that is needed to emerge from the ecological and environmental crises that were already becoming evident on a planetary scale during the 1970s. However, he did not advocate comfortable utopian schemes; instead, he suggested taking on the physical, real, and concrete business of design:

> 'It is a choice between destructive pessimism and constructive pessimism: our preference as designers is for the latter. For us, there exists only one option: always and repeatedly to reject everything that can threaten human survival; to help defuse the "time bomb," in other words, to respond to irresponsible growth with responsible control, to respond to congestion with direction. In short: we choose design.'
>
> (Maldonado, 1970, p. 81)

Corollary of Collaboration and Interscalarity

Any plan to combat a crisis—related to climate, especially—can only be implemented through a united effort aimed at establishing a collaborative process whereby institutional and private parties look past the short term and beyond individual interests. The planned interventions must be of interscalar nature: From a single element to regional, national, and global scales.

Large-scale initiatives such as the Great Green Wall in Africa (UNCCD, 2022)—which, as the name suggests, is an imposing barrier (or, in reality, a mosaic) of forests, pastures, and agricultural lands extending from east to west across the Sahara and the Sahel—are designed to operate at the local, regional, and supranational scales. The Great Green Wall program, endorsed by the African Union and involving more than 20 countries, aims to combat growing desertification by mitigating and adapting to the effects of climate change on water cycles. A similar initiative in China is the Three-North Shelter Forest Program, which began in 1978 and aims to plant a long wind-breaking forest that will hold back the expansion of the Gobi Desert (Zhai et al, 2023) while providing the local population with timber.

These large-scale forestry projects have a notable precursor, namely the 15th-century Woods of San Marco in northern Italy, an asset that provided the Venetians with a source of timber and a means of safeguarding the delicate hydrogeological balance of their city's lagoon. The woods of Cansiglio, Somadida, Montello, and Montona in Istria were indeed forestry reserves managed by the Republic of Venice (Moreschi Casti and Zolli, 1988). In the 14th and 15th centuries, with timber being over-harvested by the local populations and with increasingly unstable water levels in the area resulting in more frequent flooding caused by intense deforestation, the Republic was forced to regulate the felling of trees and establish formal cultivation plans to keep the production capacity of the forests on a sound and sustainable footing. Thus, from the 16th century onwards, Venice gave organic structure to a prudent and all-embracing model of governance over its possessions, which included protecting and making the most of woodland and forestry resources.

Even small- or micro-scale projects can contribute to adaptation. Architect Peter Trautwein is building fog nets in several countries around the world (Aqualonis, 2023). Inspired by the traditional experience of fog collectors, the system is based on the condensation of water vapor from the air, transforming fog and dew into drinking water. Similarly, architect Arturo Vittori designed a tower to generate water in arid environments called Warka Tower (Warka Water, 2022). Tested for the first time in 2015 in Ethiopia and later in Cameroon, this device produces 40 to 80 liters of water per day, depending on the weather conditions. Community collaboration is essential since indigenous materials and traditional forms are reinterpreted from time

Figure 1.3 | Making water from fog collectors in Morocco by Peter Trautwein. Photograph by Peter Trautwein. Copyright by Aqualonis.

Figure 1.4 | A detail of the drops of water harvested from fog nets by Peter Trautwein. Photograph by Peter Trautwein. Copyright by Aqualonis.

to time in the construction and final design of the Warka Tower. Project participation and management by the people allow for the development of local agriculture and the project's success.

Corollary of (Co)Design by People, Animals, and Nature
To effectively respond to climate urgencies, administrators, institutions, planners, associations, communities, people, living entities, and natural elements must design and (co)design together with the landscape.

Here, I mention three projects that involve collaboration between man and nature to tame the destructive power of water. The first project started with a collaboration among people following a traumatic event. After suffering a devastating earthquake followed by a tsunami on March 11, 2011, in Iwanuma on the coast of Sendai, Miyagi prefecture, Japan, local communities have planted a series of 'forest walls' in the coastal dunes to dissipate the strength of future tidal waves. Taking up the Miyawaki method (Miyawaki, 1999; 2004) and initiating participatory projects sponsored by the Morino Project Foundation (Morino Project, no date), the landscape approach involved the reforestation of coastlines to protect communities. Pioneer species and indigenous trees were planted tightly and haphazardly since the proximity of the plants promotes competition and accelerates the growth process. This method can grow mature forests within 30 years, instead of the 150–200 years it would normally take.

The last two projects started with the (co)design of the landscape architect with natural forces. Sea currents help in the movement of sediments, wind accumulates sand, and animals themselves could contribute to the design of a climate-resilient landscape. Even at the nano-scale level, bacteria, viruses, fungi, algae, plants, and insects can also open the doors to experimentation.

For example, Kate Orff and the office SCAPE developed and experimented with an active oyster reef to protect the New York coastline and purify the water (see Chapter 7). Moreover, the landscape architect Georges Descombes reconfigured the riverbed of the Aire River in Switzerland by exploiting sediment flows (see Chapter 3). The river, which was channelized over centuries, was re-naturalized starting from the design of a creative diamond pattern. The water flowed into the new channels, eroded the riverside, and transported sediments, thereby redefining new riverbed branches. The designer defined a trigger mechanism for the process; in this case, the diamond pattern. Thus, nature, the sediments, and the river are the protagonists of the transformation. Collaboration between man and nature is already a possibility.

Corollary of Design Error
Climate change predominantly affects urban systems that have been developed in unsuitable areas, such as coastal locations as well as water-endangered and/or geologically hazardous areas. But when town planning choices are made, the elements of the landscape must be given due respect from the initial steps of the design process. Damage repair through remedial landscaping measures will not be sufficient to restore initial conditions.

In his celebrated book *Design with Nature* (McHarg, 1968), architect Ian McHarg highlighted the absolute need for large-scale undertakings in which simple nature-based solutions could counteract environmental imbalances that were already observed. The destruction of natural dune and forest systems in coastal areas and the urbanization that followed was identified by McHarg as the main cause of potential disasters. However, water per se was not the destructive force. Instead, the inadequate interventions of humans provoked sudden and rapid changes. Today, many scientific reports, including those from the Intergovernmental Panel on Climate Change (IPCC, 2021), agree that the climate change we are witnessing is caused by humans. Notably, the Anthropocene era includes the climate and water crises.

Corollary of New Paradigms
The climate crisis prompts and demands a change in the paradigm, design, and tools employed. In short, climate change(s) design.

In recent years, people have begun to see the importance of building *with nature* rather than *against it*. This is a principle discussed by designer Bruno Munari, albeit on a different scale, in his piece *Il Mare Come Artigiano* ('The Sea as a Craftsman'):

> 'You throw something in the sea, and the sea (after an unspecified and indefinable time) returns it to you worked, finished, polished, shiny, or dull depending on the material, and wet too because when wet, the colors are more intense.'
>
> (Munari, 2002, p. 8)

Sea, sand, wind, and nature generally take on the role of craftsmen who shape, mold, and fashion things for humankind. The Sand Engine (De Zandmotor, 2023), an experimental project on the southern coast of the Netherlands, illustrates this principle perfectly: Harnessing natural forces can be of help (e.g., in combating coastal erosion). The project involved creating a substantial artificial peninsula covering an area of approximately 1 km^2, which would be distributed along the entire coastline by exploiting the action of waves, wind, and currents over a period of 20 years. This system will save energy and expense given that in the past, the beaches were artificially replenished with sand every five years as a means of keeping erosion at bay.

Figure 1.5 | The Aire River project by Georges Descombes and Superpositions and its evolution through time from 2016 to 2023. Collage by Laura Cipriani. Images by Esri World Imagery Wayback.

Corollary of Simplicity

The climate crisis is a complex phenomenon that has systemic repercussions on other crises. Design and planning can mitigate complexity through simplicity, starting with simple elements compatible with the peculiarities of the landscape and local populations.

The solutions, which may be similar to others adopted elsewhere, must be devised and adapted to each landscape since every location is unique and non-replicable.

Several projects carried out in Indonesia by the Dutch organization EcoShape show how simple—and sometimes quite basic—devices can bring about an appreciable adaptation of land systems to climate change (EcoShape, 2023). Erosion, subsidence, and rising sea levels are predominant and complex threats to coastal villages in the north of Java. While adopting a strategic vision for the whole area, the work involved placing a number of barriers in the sea, consisting of stakes and brushwood, which were designed to favor the deposition of sediments in order to re-establish a coastal mangrove strip previously destroyed by human activity. Built by the local communities, the elementary structures filter seawater, trapping solids while simultaneously attenuating the force of wave motion. Using this simple, low-tech system, the level of the seabed near the coastline can gradually be raised to allow the natural regrowth of mangroves over time. Reinstatement of the mangrove strip has the effect of defending against coastal erosion, increasing biodiversity by attracting a variety of fish fauna, and purifying the water. Finally, the involvement of local communities in the design and management of the scheme bodes well for its successful long-term implementation.

5 | *Axiom of Time and Timeliness*

The variable of time—short, medium, and long term—is fundamentally important in shaping the design of the future and present. The solutions proposed must advance toward the future through small steps. Like design, the concept of time varies across different cultures. Moreover, design should consider diverse time notions when dealing with water and climate issues.

In the sphere of town planning and landscaping disciplines, the scenario tool has taken on a role of special significance in exploring a future characterized by uncertainty and complexity from a hypothetical standpoint. Planning based on scenarios is a process of answering the question 'What happens if…?,' stimulating a discussion on the future that is reflected indirectly onto the present. Climate-related uncertainties are often addressed through a process of forecasting long-term and very long-term scenarios (2100), whereas the scenario method has rarely been adopted for short- to medium-term studies. For example, if we were to begin planning the future today,

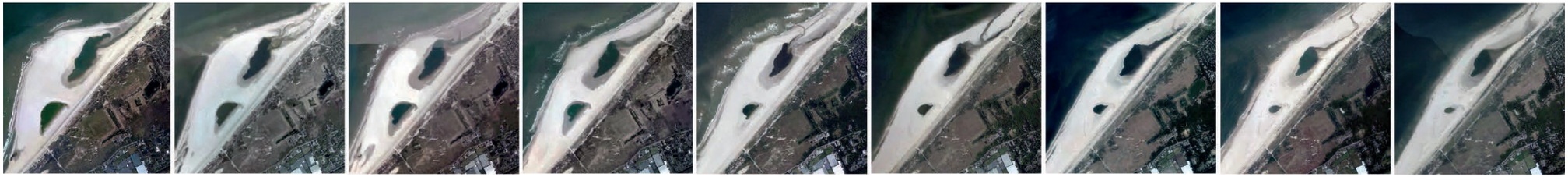


Figure 1.6 | The sand motor project in the Netherlands and its evolution through time from 2012 to 2019. Collage by Laura Cipriani. Images by Esri World Imagery Wayback.

what scenarios would be envisaged for 2025, 2035, and 2050? But more importantly, what will be the scenarios for 2050 if planning is left until an emergency strikes and inevitable disasters have already occurred?

Catastrophe theorist René Thom plainly demonstrated how both *time* and *timeliness* are variables that cannot be ignored if we are not to be dominated by the inevitability of fate:

> '(…) there are many examples of perfectly understood situations in which there is no possible course of action. For example, there is a man on the roof of a flooded house who watches the water rise to inundate him. Inversely, there are situations where one can act efficaciously without understanding why. Where we cannot act, there remains only to show courage against misfortune and to stoically accept destiny's verdict. The world is teeming with situations in which we can clearly intervene, but without really knowing how the effect of our intervention is going to manifest itself.'
>
> (Thom, 1979, p. 11)

Like design, the concept of time varies across different cultures. Design should also consider diverse time notions when we deal with water and climate issues. Western countries mostly rely on a notion of linear time that considers time to be a limited resource. Time is money. Climate change losses urge solutions and a proactive attitude. While South American and Mediterranean countries conceive time as a linear process, the notion implies a multi-active view focusing more on the present rather than on a scheduled process. This might justify a less proactive attitude in planning for future climate actions.

Asian and African countries are mostly based on a cyclical concept that extends to the duration of the day, season, year, and life. This likely implies that climate disasters are part of a cyclical repetition sometimes linked to religious beliefs.

6 | *Axiom of Palimpsests*

Climate events of the past, which have occasionally been catastrophic, are crystallized in palimpsests of the present-day landscape and can provide an important guide to reprogramming the future landscape. History, maps, and the documentation of written sources and documentable iconographic media have a fundamental role to play in the process of designing the future landscape.

A traumatic event such as the eruption of Mount Vesuvius in 79 AD provides a good description of how the landscape can be *read* by studying palimpsests and observing the natural and anthropic traces left over the centuries. Not only did the detritus and mud produced by this disaster destroy and bury the Roman towns of Pompeii, Herculaneum, and Stabiae,

but they also changed the geography of the area. The amount of material that erupted was such that the river Sarno changed course toward the east, and the coastline, characterized at the time by a lagoon—the *dulcis Pompeia palus*—facing the river, was transformed into the Stabian Plain of today (Cinque and Russo, 1986).

Similarly, studying the palimpsests of a river system is an essential part of understanding and planning for future climate crises. For example, the celebrated geological mapping of the Mississippi floodplain by Harold Fisk in 1944 (Fisk, 1944) provides an invaluable reconstruction of how the riverbed has evolved over thousands of years. The stages in the life of the watercourse are represented by different colors—green, blue, yellow, red, and orange—in what is almost a work of art as well as science, showing the events and critical changes in the paleo-riverbed.

Therefore, territorial palimpsests are an important aspect of study, research, and design since they can show us the recurring events that took place in the past, presumable changes in the landscape following traumatic events, and possible design solutions for the present and future.

7 | *Axiom of the Cultural Landscape and the Imaginary*

Context matters. The actions required to combat the climate crisis are not universally applicable at all latitudes but will vary depending on the particular situation and cultural landscape. Populations of different cultures respond with different solutions, which are associated with different imaginaries. The imaginary changes not only on a cultural level but also in response to events occurring over time.

Design is always a product of culture, developed in relation to the place where it is rooted. Take the Wadden Sea as an example, which is a mosaic of tidal mud flats along the southeast coastline of the North Sea that creates a long strip of wetland common to three different countries: Netherlands, Germany, and Denmark. These three countries adopt dissimilar coastal defense strategies linked to three distinct cultural approaches since the response of each nation to rising sea levels along their respective seaboards is based on different intentions: Acceptance, adaptation, and resistance. Denmark has abundant coastal areas and no substantial concerns about losing a small amount of land here and there. Accordingly, its policy has been to build a few dikes and allow the sea to shape the future coastline as it may. The Netherlands is a small country with extensive areas of land situated below sea level; therefore, the Dutch are always seeking new methods of adaptation and reclamation: Beaches are replenished with sand, imposing dikes are built, and only where such actions are not strictly feasible will the sea be left to its own devices. Finally, the unbending Germans see the current coastal water line as a front on which they must wage war against the sea, and from which the coast must not recede.

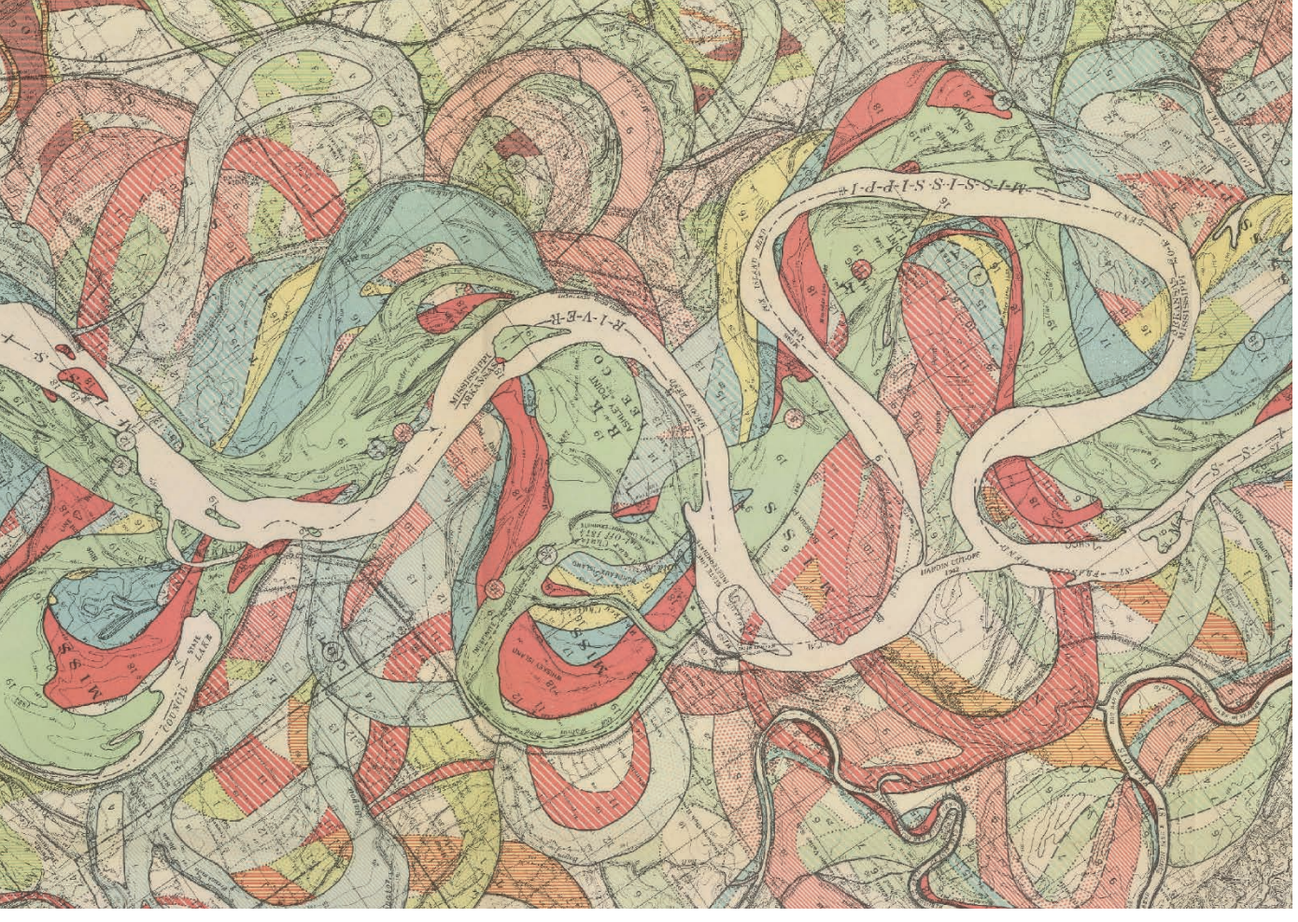


Figure 1.7 | A detail of the colored map of the Mississippi River geological evolution by Harold Fisk. Image by Harold Fisk.

The self-same imagination of the relationship between man and the sea has changed over millennia of history in these parts. The first colonies to be established here approximately 6,000 years ago accepted with equanimity that dwellings, wheat fields, and pastures would often be flooded: The sea was a precious source of nutrients. When the floods became frequent, they raised mounds on which to place their homes, but then the waters began to press hard and they were obliged to build the first earthwork embankments. At this point, the imaginary of the sea began to change: Once a friend, it was now an enemy from which they defended themselves by building a continuous rampart along the coast. And so, the imaginary also changes in response to events.

8 | *Axiom of Climate Injustice and Design Imperialism*

Climate change is a global and a local problem, of which the effects are felt more strongly in certain areas of the planet. Many Asian countries and landscapes and/or developing countries in Africa and South America are those most heavily affected by climate change, despite not being primarily responsible for it.

Consequently, there is a new form of Western imperialism holding sway over many areas of the planet—albeit indirectly and unintentionally—inducing local populations to abandon their homelands and initiating new flows of migration. Based on projected scenarios for population growth and warming over the next 50 years, some authors (Xu et al, 2020) have estimated that between one and three billion people will be living in areas with warmer—and in some cases, extreme—climates. Thus, they will likely migrate toward more temperate zones in a bid to secure the basic necessities of life. Notably, water will become an even scarcer resource.

Paradoxically, in many Asian, Southeast Asian, and other developing regions, we assist in a sort of 'design imperialism' related to water and climate issues. Western projects and knowledge become portable solutions to be applied in other contexts and reveal all their limits: Indifference to local knowledge and wisdom, indifference to local communities' needs, and a climate change design that is not site-based in terms of all its social, economic, and morphological aspects. Design imperialism is a process that is mostly justified by speculation and profit for real estate construction. On this topic, Yarina (see Chapter 5) unveiled how large Western corporations sell inappropriate 'imageries of resilience,' which transform into designs for the climate that are mainly driven by capitalist logic.

9 | *Axiom of Economy*

In plans aimed at mitigating and adapting to the climate crisis, protection from damage must be combined with the production of economic value. A direct economic benefit can provide the incentive needed to overcome the crisis.

It often occurs that damage to the environment caused by climate change is evaluated while ignoring the fact that only a plan capable of generating new economies and innovations can ultimately be effective. Working with less is always preferable. As Gilles Clement stated, working *with* whenever possible and *against* as little as possible is 'a way of thinking that allows (…) to be organized with a view to the greatest economy of means. It presupposes accepting and sometimes even developing ways of collaborating with energies already present, principally those that nature offers in every circumstance and region of the world. It implies being sparing in the consumption of negative energy and if possible, doing without it altogether' (Clement, 2015, p. 34).

10 | *Axiom of Hope*

If catastrophe leads to the failure of one system and the establishment of another, even the simple threat of a catastrophe could bring about positive changes and create new hope.

In an article entitled 'How Climate Change Might Save the World,' Ulrich Beck—risk theorist par excellence—offered a thought that carries hope for the future: The notion that catastrophe becomes a metamorphosis for the whole of society. 'Global risk comes as a threat and brings hope' (Beck, 2014, p. 97). If the proposition that climate change is real becomes definitively accepted, stated Beck:

> 'It induces the necessity (…) to perceive and to practice new forms of transnational responsibility; it puts the problem of cosmopolitan justice on the agenda of international politics; it creates informal and formal cooperation patterns between countries and governments that otherwise ignore each other or even considers themselves enemies: It makes economic and public actors accountable and responsible—even those who do not want to be accountable and responsible. It opens up new world markets, and new innovation patterns, with the consequence being that deniers are losers. It changes lifestyles and consumption patterns; it reveals a strong source of future-oriented meanings in everyday life and for the legitimation of political action (reforms or even revolutions). Finally, it induces new forms of understanding and caring for nature.'
>
> (Beck, 2014, pp. 97–98)

'Active hope' (Macy and Johnstone, 2012) stimulates new practices and a new collective consciousness, as noted by Johanna Macy. People coordinate their actions through a collective thinking process that she describes as 'distributed intelligence' (Macy and Johnstone, 2012, p. 99). Finally, as we will sustain in this book, hope considers the potential of imagination that landscape architecture can drive through a collective (co)designed practice.

Figure 1.8 | Olafur Eliasson and Minik Rosing, *Ice Watch*, 2014. The installation took place at the Bankside, outside Tate Modern in London in 2018. The work raises collective awareness of climate change by providing a direct and tangible experience of the reality of melting arctic ice. Supported by Bloomberg. Photograph by Charlie Forgham-Bailey. Image courtesy of Olafur Eliasson; Neugerriemschneider, Berlin; Tanya Bonakdar Gallery, New York, Los Angeles. Copyright by Olafur Eliasson.

Figure 1.9 | Olafur Eliasson and Minik Rosing, *Ice Watch*, 2014. Listening to the melting ice of *Ice Watch* raises emotional engagement on climate change issues. Supported by Bloomberg. Photograph by Charlie Forgham-Bailey. Image courtesy of Olafur Eliasson; Neugerriemschneider, Berlin; Tanya Bonakdar Gallery, New York, Los Angeles. Copyright by Olafur Eliasson.

Book Structure: Liquid, Solid, and Gas

Today, humans' relationships with water are changing. Water was controlled and regimented in rigid shapes for a long time. Dams and floodgates kept water away in the name of hydraulic safety. However, climate change has prompted a radical change in this design approach. *Working with* rather than *against* water has opened up new possibilities for collaborative design.

This book gathers essays on aquatic landscapes facing climate change challenges and hopes that can spring from collective design in its broader meaning. Through exploring landscapes at different scales, the book focuses on landscape design grounded in different geographies and cultures where (co)design involves all living and non-living systems.

The presented essays deal with aquatic landscapes in transition and are organized into the three states of water as they relate to climate change—liquid, solid, and gas—and their forms. In Latin, the term *form* means *to hold* or *to support*, from which the term *firmus*, which means *stable figure*, is also derived. In the liquid state, water has no shape and assumes a form depending on the support in which it resides. Water is always unstable since it constantly moves in the water cycle. From the soil to the groundwater. From rivers to the ocean. From the ocean to the atmosphere. Evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, and subsurface flow are the physical processes of this constant movement. Today, these changes are becoming increasingly evident. Climate change causes the progressive retreat of glaciers, changes the courses of rivers and sea levels, and upsets water cycles and evaporation phenomena.

When speaking of forms, we refer to the three states of water. However, we can also interpret the term as the Greek *morphé*, which includes perceptual forms of design that arise from the landscape designer's gaze (i.e., the authors of this book).

The opening section, 'Liquid | Water,' discusses collaborative design practices in coastal and riverine areas. Peter Veenstra (see Chapter 2) proposes a collective design manifesto outlining ten climate-adaptive principles drafted with eight landscape design agencies. In his well-known project, Georges Descombes envisions the Aire River as a (co)designer (see Chapter 3). Martini (see Chapter 4) promotes the need to go beyond rigid defense infrastructure in Japan and (co)design for better futures with local communities and natural elements. Addressing Southeast Asian coastal and deltaic megacities, Yarina (see Chapter 5) advocates for overcoming pre-determined models or imported design projects and producing new, local, and collective imaginaries of resilience. Bobbink and Chouairi (see Chapter 6) discuss traditional water systems as the product of collective thinking by local communities. Brashear (see Chapter 7) decomposes the SCAPE manifesto-work 'Living Breakwaters' as a social and ecological engine for collective engagement. Georgieff (see Chapter 8) brings us under the sea to fight the climate crisis through collaboration among researchers, academics, biologists, fishermen, divers, artists, and the silent work of marine living systems.

The second section, 'Solid | Ice,' which might sound like an oxymoron at present, questions the solidity of ice in the era of climate change. The projects noted in this section represent an attempt to raise public awareness and engagement on the issue of climate change while also highlighting unexpected examples of the hopeful adaptation of some local communities.

For example, Tynan (see Chapter 9) proposes a tempo-material approach for (co)designing with time on the Arctic island coast of Bjørnøya. Clouse (see Chapter 10) introduces the climate-adaptive artificial glacier projects of Ladakh, north India, as a way of integrating (co)design by people and natural forces. Berger (see Chapter 11) documents the collective work of researchers and students listening to melting glaciers in the Swiss Alps to raise awareness of our commonality, interconnectedness, and responsibility in the climate crisis.

The final section, 'Gas | Fog and Clouds,' collects design practices related to the third state of water. These include projects and natural phenomena dealing with water and atmospheres, comprising landscape practices and artistic interventions aimed at 'making water' from clouds, fog, and moisture. Gilles Clément and Laura Cipriani (see Chapter 12) describe 'cloud gardeners' that cultivate clouds in dry regions of the planet. Mosbach (see Chapter 13) presents the Phase Shifts Park project to highlight how new water is 'cultivated' by the biomass introduced by it. The water cycle relays life from the depths of roots to the foliage, which evaporates the surplus in the form of oxygen into the sky. Abdessemed and von Raven (see Chapter 14) present their microclimatic installation at the Architectural Biennale in Venice, which features an accessible indoor cloud. This experiment is not far from humans' control of the weather on a global scale.

Finally, the last chapter from Knox and Holmes (see Chapter 15) goes to the roots of the meaning of (co)design, highlighting a symphonic choreography of all planetary forces involved in the water cycle and beyond. An interdependent design dance that can listen to the cosmos' needs and employs aesthetics and techniques to address the climate crisis.

Figure 1.10 | Berndnaut Smilde, *Nimbus Roebourne*, 2017. The artificial clouds of Berndnaut Smilde in Western Australia. Photograph by Bewley Shaylor. Image courtesy of Berndnaut Smilde and Ronchini Gallery.

Figure 1.11 | Berndnaut Smilde, *Nimbus Roebourne*, 2017. The process of making a cloud. Photograph by Annegret Kellner. Image courtesy of Berndnaut Smilde and Ronchini Gallery.

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