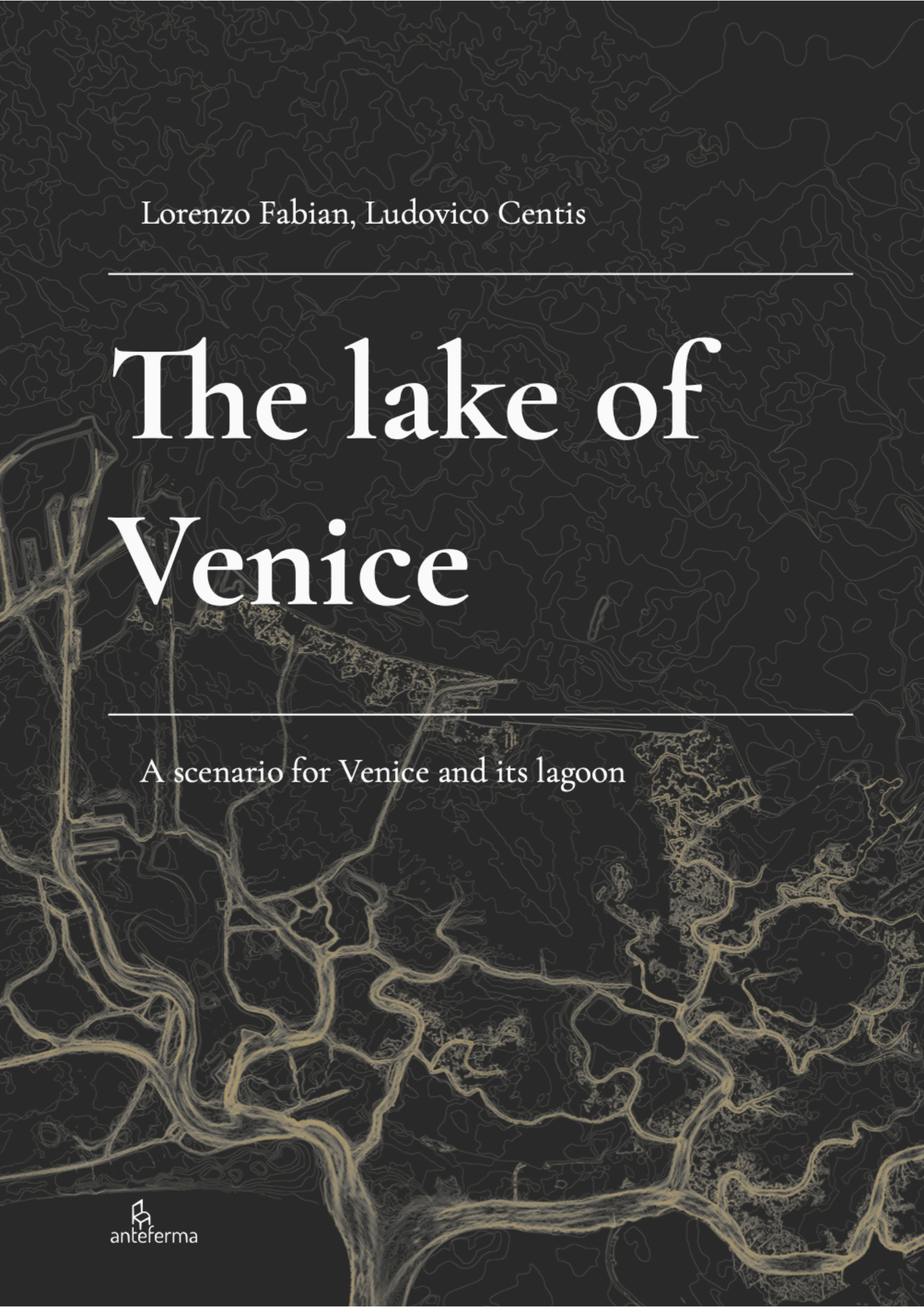
Lorenzo Fabian, Ludovico Centis

The lake of Venice

A scenario for Venice and its lagoon



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Foreword

Once again in its long history, the Venice lagoon needs profound rethinking in the light of the environmental crisis, demographic decline, and the tourist pressure it is under. This book on the future of the lagoon stems from the urgency that emerges from these aspects and as a synthesis of an exhibition, as well as of a series of ongoing research and educational experiences in which we are involved.[1]

Starting from the entry into operation of the MoSE and the scenarios related to the expected climate change, our contribution as architects and urban planners – entrusted with the task of bringing a gaze able to encompass such a broad and articulated framework– is to synthetize the possible vanishing points that the future of the lagoon delineates. The economic, environmental, and social challenges that characterize the metropolitan city built around the Venice lagoon are profound and to some extent unique but, as Secchi reminds us, they are part of a new global urban question with which all cities will be confronted (Secchi, 2011; 2013).

Introduction

The conclusions of the first scientific report on climate and environmental change in the Mediterranean region, presented at the Forum Régional de l'UpM on 10 October 2019 in Barcelona, tell us that the Mediterranean space is warming up 20% faster than the rest of the world. Such changes will have major impacts on temperature, precipitation, atmospheric circulation, extreme events, sea level rise, seawater temperature, salinity, and acidification (Cramer, Guiot, and Marini, 2020).

The Mediterranean is a 'geopolitical paradox' (Spadaro, 2020), an increasingly enlarged and fragmented shared space at the centre of one of the geographical areas of greatest transformation due to climate change, profound and tragic social and economic changes, and impetuous demographic transformations. We know the planet is transforming. The dynamics linked to the climate draw unexpected new geographies, and the scarcity of fossil fuels and natural resources reveals new lands to be abandoned and others to be plundered and exploited. The crisis conditions that characterize this great 'sea between the lands' today reflect this worrying climate picture. The Mediterranean has also become the epicentre of violence and urbicide (Albrecht *et al.*, 2017): it is perhaps necessary to have a broad reference horizon in order to solve specific and local problems linked to crisis situations.

The design studio 'The New Mediterranean System'[▸2] of the master's degree in architecture of Università Iuav di Venezia had the objective of constructing a framework project for the Mediterranean space and defining an image, a far-reaching proposal towards a peaceful future for 500 million people able to meet the environmental, energy, and geopolitical challenges in progress. The unified Mediterranean project reconceptualizes the original idea of 'Le Système de la Méditerranée' introduced at the beginning of the 19th century by Michel Chevalier, where for the first time this 'sea between the lands' was understood as a *unicum* (Chevalier, 1832). From a geopolitical point of view, the Mediterranean continues to be the geographical field described by Fernand Braudel, a 'fissure in the earth's crust' which has become a crossroads of cultures and trade in goods, which united and unites around itself, often in a conflicting way, three types of civilization: that of the Christian West which had its centre in Rome and from which Europe was born; that of Islam, stretching from Moroc-

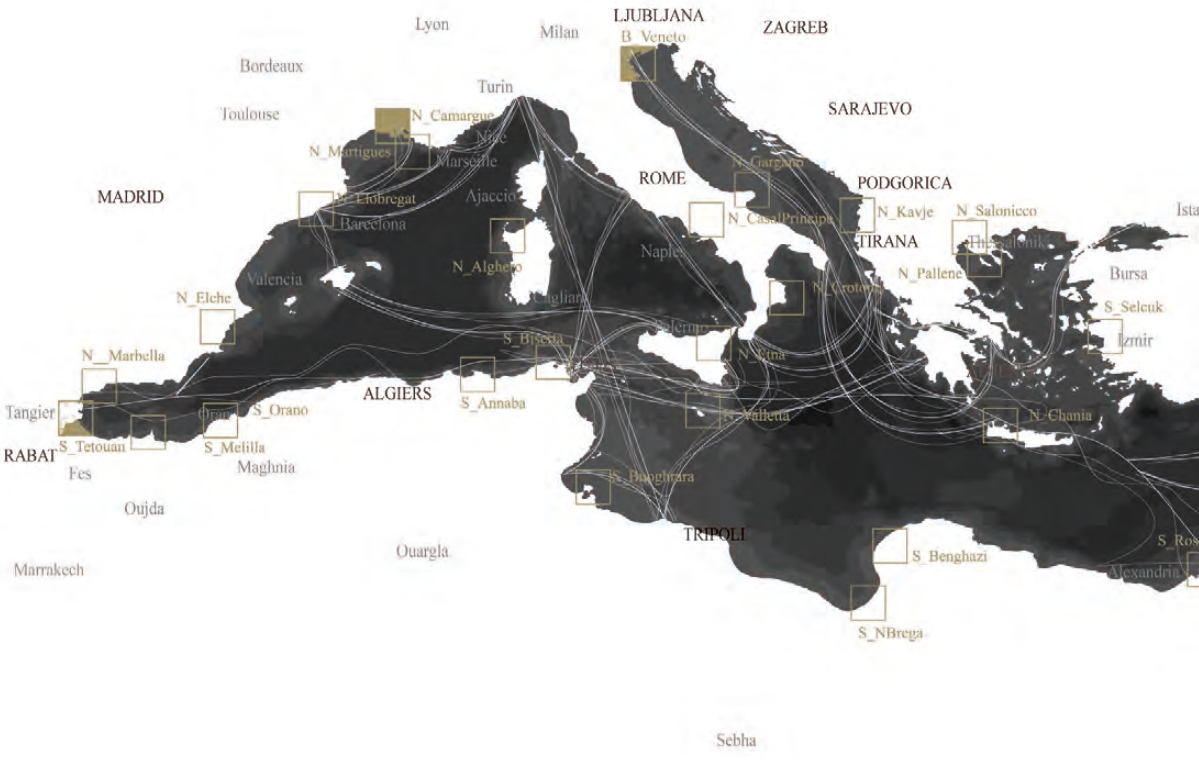
▸1 Exhibition: *Venise* (2021), expo at the Musée des civilisations del'Europe et de la Méditerranée (MuCEM), Marseilles (Fr). Research activities: *L2 Tourism and Cultural Heritage LAB* (2021-2022), funded by the Industrial Rehabilitation and Reconversion Project, Venice Complex Industrial Crisis Area; *VENETO SUSTAINABLE SMART TOURISM 2030*, (2020-2021) funded by the European Social Fund Regional Operational Programme, Veneto Region; *Paleoalvei della Laguna* (2019-2020), research carried out in the framework of the activities of the programme 'Venezia 2021 Scientific research programme for a regulated lagoon' funded by CORILA (Consortium for the Coordination of Research on the Venice Lagoon System). Educational activities: *The New Mediterranean System* (Academic Years 2019-2020, 2020-2021) design studio of the master's degree in Architecture of Università Iuav di Venezia; *MéLiMed Métropoles du littoral méditerranéen, enjeux climatiques et solutions de résilience* (Academic Years 2021-2023) educational project Erasmus Plus, Ecole Nationale Supérieure d'Architecture de Marseille (PI), Università Iuav di Venezia, Faculté d'architecture La Cambre-Horta ULB Bruxelles, Ecole Nationale d'Architecture de Tétouan Maroc; *Scenari della laguna* (Academic Years 2018-2019, 2019-2020, 2020-2021) design studio of the bachelor's degree in architecture of Università Iuav di Venezia. For details see the *Research and teaching credits* in the *Appendix* at the end of the book.

co to the Indian Ocean; and finally the Greek-Byzantine one, a bridge between Asia Minor and the Balkans (Braudel, Coarelli, and Aymard, 1977). According to Henri Lefebvre, historically the cultural unity between the Mediterranean countries was organized around multiple forms of exchange based on 'tacit or explicit forms of alliances' (1992). In this context, starting from environmental issues, water can still assume the role of a central and unifying issue. In the south, from the African coasts to southern Italy, Turkey, Greece and Spain, water will increasingly become a problem of scarcity, declared in the themes of the territorial project to defend against desertification and drought, from heat islands and the danger of fires. To the north, in the territories bordering the northern coasts and in the hinterland of the floodplains of large rivers, the water problem is, and will increasingly be, a problem of defence against floods, overflows and sea level rise. These aspects touch the territories of the Camargue and the nearby production area of Martigue in Marseille, Kavaje in Albania, Elche in Spain, and Rosetta, the terminal point of the metropolis of Cairo on the Nile Delta. Territories that, like Venice, will see their existence increasingly threatened by the rise in sea level and for which it seems possible to explore the adaptive dimension of the amphibious project, through the construction of new lagoons, inhabited wetlands, and environmental reserves in the heart of a new metropolitan dimension.

In 1984, to highlight the different conditions of the urban project, Bernardo Secchi published in *Casabella* an essay entitled 'The conditions have changed' in which he pointed out 'the halting of migratory flows, of the growth of large cities, the slowdown of construction in urban areas and its displacement to other dispersed places, industrial delocalization, the progressive emergence of the urbanized countryside, widespread industrialization, the extension of the landscape of metropolitan suburbs' (Secchi, 1984) as signs of profound change. Today, in the light of the economic crisis at the beginning of the millennium, the environmental problems linked to climate change, the exhaustion of fossil fuels and the geopolitical tensions that follow, the global change we are experiencing has become increasingly evident. This appears even more true today, when as we write, the crisis deriving from the pandemic we are experiencing has been added to the environmental and economic emergencies. It is the opinion of many that the

►2 The activities of the design studio 'The new Mediterranean System' of the master's degree in Architecture of Università Iuav di Venezia are part of the broader Erasmus+ MéLiMed (*Métropoles du littoral méditerranéen, enjeux climatiques et solutions de résilience*) an educational and research project to counter the environmental risks that loom over the Mediterranean space. During the three-year duration of the project the issue of the resilience of the Mediterranean coastal territories and metropolises to the challenges posed by climate change and rising seas is addressed, starting from three coastal cities –Venice in Italy, Marseille in France, and Tétouan in Morocco– through educational workshops involving instructors and students from the partner schools. See *Research and teaching credits* in the *Appendix* at the end of the book.

world we will find at the end of this health emergency will never be the same again (Harvey, Camp, and Caruso, 2020). On the one hand, together with our lifestyle, the paradigms around which the social and anthropological structures of our societies and of our country, based primarily on human contact, on interpersonal and trust relationships, have now been put into question. On the other hand, the faith that had been placed on an economic model based on production chains on a global scale will change. Furthermore, what we are experiencing teaches us that the future is often unpredictable, that what we have achieved should not be taken for granted, that the world and its resources (material, economic, environmental, and social) on which we could count and that until yesterday we thought indisputable are actually very fragile, and we must take care of them, because everything can suddenly



The new Mediterranean System
Framing and study areas.

change. This experience speaks to us of our greater or lesser capacity to adapt to risk and disasters, whether they concern health like today, or the environment –and access to resources– as they certainly will tomorrow. It is evident that all this will also have a cascade effect on the territory of the Venetian metropolis and on confidence in the large and small projects that are presently under construction. More generally, if we look away from Venice to the urbanized world, there will be an impact on the ways of rationalizing –and designing– the city, on public space intended as a space for democracy, on production chains and access to raw materials. Our research also fits into this framework dominated by uncertainty. We need to be prepared, with new planning models that know how to prepare for the unexpected (Arnoldi *et al.,* 2020).

The regulated lagoon

In 2018, the CoRiLa consortium launched a new research programme called *Venice 2021* which intends to investigate the evolution of the Venetian territory in light of the entry into operation of the MoSE, when the Venice lagoon system will become 'regulated'. The broader work programme contemplates the creation of 'new scenarios' for the future of Venice and its lagoon and involves a large number of researchers, hydraulic engineers, environmental scientists, technologists, restoration experts, chemists and biologists.[3] In the aftermath of the tragic flood of 2019, the controversy over the long-term effectiveness of the MoSE and the various hypotheses of closure of the lagoon, our research is the illustration of a possible scenario for the future of the lagoon and the verification of its possible legitimacy.

The lake of Venice is neither necessarily the only possible scenario, nor the best one for Venice. It is not even an unprecedented scenario. However, we believe it to be a plausible one. A scenario developed starting from an in-depth historical knowledge and the awareness that, as D'Alpaos and Rinaldo underline, transformation represents the only alternative to the extinction of the lagoon: 'It should be noted, aside from the study on the evolution of the shape and function of the Venice lagoon, that the concept of equilibrium, in the static sense of maintenance and conservation that it suggests, has no place in natural evolutionary phenomena, especially in the Venetian context. As extinction is the only

[3] Scientific activity carried out in the frame of the *Venice 2021* research program, with the contribution of the Interregional Authority for Public Works for Veneto, Trentino-Alto Adige and Friuli Venezia-Giulia, provided through the Concessionaire Consorzio Venezia Nuova and coordinated by CORILA (Consortium for the Coordination of Research on the Venice Lagoon System) with Iuav, Ca' Foscari, Padua universities and the national research bodies CNR (National Research Center) and OGS (National Institute of Oceanography and Experimental Geophysics). See *Research and teaching credits* in the *Appendix* at the end of the book.

alternative to evolution (of the residual lagoon forms and their environmental, physical, cultural services), the study of the many lagoons that have occurred in their evolutionary history aims to provide elements for informed historical analysis and to make transparent the causes and effects of measures aimed at the restoration, conservation, or use of the lagoon environment. The rigorous analysis aims to create sharing, conscious cooperation, moral commitment' (D'Alpaos and Rinaldo, 2015, p. 35).

According to Bernardo Secchi, in contexts dominated by uncertainty, 'The main [task of urban planning is] the idea of a continuous, patient construction of scenarios. [...] In a democratic and open society, everyone is free to make proposals and to justify them by resorting to the arguments they deem most appropriate. [...] But the task of every intellectual who claims legitimacy, including architects and urban planners, is to subject each of these ideas to a severe critical scrutiny, transforming them precisely [...] into scenarios' (Secchi, 2002). By mobilizing the tools of the territorial and landscape project –and based on the hypotheses of closure and compartmentalization of the lagoon advanced by some authoritative scholars– our research attempts to look at the past in a speculative way to critically rethink the present and imagine an alternative future. For this reason, the history of the lagoon plays an important role here. In fact, on the one hand, it allows us to understand that the environmental threats to which the lagoon is currently subjected are not entirely new. On the other, it assumes a crucial role as an empirical but indispensable framework for reasoning on the legacy of past projects and therefore on the legitimacy of the ideas and projects for tomorrow.

Chapter 1

On the lake of Venice

Venice, year 2100.

In 2100 the ancient Venice lagoon is divided into three parts. The central part, the lake of Venice, is a large hypersaline water space, protected by an embankment that preserves the immense monumental deposit of the historic centre of Venice and the other major islands (Murano, Burano, Torcello ...). The large city of Mestre, as well as Marghera, Favaro Veneto and the Lido, overlook the lake of Venice. This city has consolidated over time into a horizontal metropolis, an active urban space, crossed by mass tourism and trade routes, punctuated by the presence of metropolitan facilities such as the Venetian universities, the Mestre hospital, the Tessera airport, the new industrial and tourist ports located along the former *Petroli Canal*, between Fusina and the Malamocco lagoon mouth. The large embankment protecting the lake of Venice relies on the one hand on the MoSE system (using the movable bulkheads and adapting them to the new needs), on the other by exploiting the pre-existing morphological elements (dunes, salt marshes, consolidated islands). Furthermore, it will be necessary to strengthen the existing embankments and dams equipped with dewatering pumps with the aim of keeping the average level of the lake water below +90centimetres compared to the zero tide level of Punta della Salute (ZMPS).

The lake of Venice is a protected area, separated from the southern and northern lagoons by the Malamocco channel (formerly *Petroli Canal*) and the ancient riverbed of the Dese-Sile that runs along the islands of S.Erasmo, Torcello and Burano, on which new waterproof structures have been established. The lake is hermetically sealed on the Adriatic front thanks to the new embankment of walls integrated by breakwaters that preserve the Lido-San Nicolò strip from possible damage caused by storm surges. Access by water to the lake of Venice is allowed only to small-sized ships without carbon emissions through special navigation locks and outflow openings that allow water exchange with the surrounding water surfaces, avoiding stagnation, maintaining healthiness and the correct salinity levels of the water. Territorial trams run along the banks surrounding the lake, where the slow mobility networks that connect Marghera and the Marco Polo airport on the mainland to the coasts of Malamocco and Punta Sabbioni are also located. At the edges of the lake of Venice are located the northern and southern great lagoons.

The two lagoons, home to numerous animal and plant species that represent a great environmental heritage for the entire territory, are designed by landscapes of mudflats, sandbanks and tidal creek that recall the

original environment of the ‘dead lagoon’. The ancient system of fishing valleys, interconnected with the centuries-old mechanisms of lagoon fluid dynamics, has been slowly converted into different and more contemporary forms of fish farming, which have become an important resource of the lagoon economy. Within

these landscapes the practices of fishing, cultivation and continuous maintenance of a fragile environment still take place thanks to the incessant work of fishermen and aquaculturists. These are the same populations of aquaculturists who in 2100 can count on a larger lagoon area of production, reconquered from the reclaimed agricultural territories following the closure of the water pumps which, until the beginning of the 21st century, kept the lands on the edge of the *conterminazione lagunare* –the administrative and juridical border of the lagoon– artificially dry. In memory of this 'paleo-lagoon', the stones that once defined the ancient boundary emerge from the water space. A large plant system acting as a forest buffer is found all around, punctuated by wetlands with macrophytic plants along the main hydrographic systems. This system guarantees the purification of the waters that come from the hydrographic system and that cross the polluted lands of the "diffuse city" located on the lagoon drainage basin. The territory of the new lagoons is crossed by the main road infrastructures that were built during the 19th and 20th centuries and which, given the original construction in relief with respect to the level of the countryside, survived the average sea rise. The sediments brought in thanks to the completion of the Padua-Venice waterway and an embank-

ment overlooking the southern lagoon along the *Petroli Canal* have allowed the terraforming of areas inside the lagoon, real inhabited islands. New navigable lagoon canals make it possible to reach these islands, secured by reinforcement embankments formed by the material resulting from the excavation of the canals.

Lagoon palaeochannels

A couple of years after the exceptional high water[►1], in the face of the incessant controversy about MoSE and more-or-less scientific ideas about the lagoon that emerge from popular debates, this text tries to deal with 'the hypothetical in a strong sense' (Badaloni, 1983, p. 40). Since the very beginnings of the Serenissima, the Venetian lagoon has been the subject of numerous ideas, plans and projects that have never been fully realized. The hypothesis that we put forward here is that these urban episodes (conceived and documented) may still be topical and capable of building new foundations for discussion about parallel lagoons. The possible story of a series of never-transformed lagoons thus becomes a tool to better understand the success and failure of the projects underway to protect the Venice lagoon.

From its origins, in fact, the centuries-old history of Venice is one of techniques, ideas, and projects to make a fragile, sometimes hostile and insalubrious territory habitable, combining the reasons for economic development with those of environmental protection. A story that in the *longue durée* is inscribed in the 'fabric' of the territory and in a specific geography that also shapes its destiny. This is true for Venice, for the Mediterranean Sea within which it has stubbornly carved out its vital space and its system of relationships, the nature of which '[...] cannot be fully understood except in the long perspective of its geological history' (Braudel, 1998, p. 15) and by the great plain to which it turns, which since prehistoric times has been 'the kingdom of rampant waters [to be] conquered against hostile swamps' (p. 15). The expression 'regulated lagoon' proposed by CoRiLa is actually an oxymoron that well expresses the ineluctable fate of the Venice lagoon, of its perpetual and centuries-old battle to oppose a specific hybrid and transitional geographical condition, whose natural future would be that of disappearing to become a part of the sea or an extension of the land. For almost fifteen hundred years, in order to oppose this natural future, man has changed the course of rivers, drained, and reclaimed entire parts of the territory, built embankments, artificial canals, bridles, dams, bridges, pumped water, consolidated mud. Within this long-term destiny, environmental, economic, political and health issues have always overlapped, and are part of the same attempt to make an uninhabitable place inhabitable

►1 187 centimetres above the average sea level, recorded at the Punta della Salute survey station at 10.50 pm on Tuesday 12 November 2019.

through the construction of a 'regulated' space. Alvise Cornaro understood this well at the time of the Serenissima, when in support of his arguments for filling up a vast part of the lagoon, together with the need for new land for food resources, he recalled the risks derived from the growing marshes and the impairment of the quality of 'good air': 'Coloro che scrivono dell'agricoltura, affermano per cosa certa, che dall'humore corotto e la puzza delli letami generano certi animaletti di tanta picciolezza, che non si possono vedere, li quali nel respirare del fiato entrano per il naso, et sono causa de una morte quasi certa subita alli animali et agli huomini' (Cessi, 1941, p. 4).[2] For Cornaro, of course, the health and environmental issues indissolubly intersect with those of economics and safety, in fact 'three were [...] the main conditions which could ensure the city long life: healthiness of the air, strength of the place, favourable living conditions for people; not easy to reconcile, because in one way or another subordinated to the maintenance of the lagoon balance, with which they could often enter into conflict [...]' (Cessi, 1941, p. VIII). The debate that arose over time demonstrates, on the one hand, how the problem with which Venice has been called upon to confront –the project of a regulated lagoon– is, and will always be, the same: combining the reasons for development with the environmental, health, social, and political issues. On the other hand, it is a story that shows us how the Venetian issues (of yesterday and today) are actually global issues which all human forms of settlement have had and will have to confront (Bevilacqua, 2009). With respect to these problems, the protagonists of our stories take a stand and propose a vision of the future through clear projects for possible lagoons.

From the particular point of view in which we find ourselves today, it seems important to observe how the need and urgency of a project for Venice with which to embody a specific vision of the world, always reappears in the course of history. This happened with particular impact in the aftermath of health, environmental or economic disasters, which therefore assume the role of planning accelerators. It is a very clear matter to Eugenio Miozzi, who three years after the tragic flood of 1966, in the introduction to the volume *Il Salvamento* (The Saving), explains to us how Venice 'has now reached a crucial point in its life, to the point where its survival or its disappearance will be decided; in the present moment any mistake can be fatal' (1969, p.11). It is in these crucial

►2 'Those who write about agriculture affirm for sure that from the corrupted nature and the stench of manure certain small animals are generated, which cannot be seen and that while breathing enter through the nose, causing an almost certain death suffered to animals and men' (auth.trans.).

moments, after a disaster but before a possible catastrophe[3], that the future is written and that the past can still be of fundamental help 'so that the experiences of the past serve the present and so that yesterday's mistakes are a warning to the operators of tomorrow' (Miozzi 1969, p. 12). The history of Venice, its waters, and its disasters, is therefore the centuries-old history of man's battle to make a home in a fragile and uninhabitable world, made up of floods, swamps and malaria. A story that looking to the past can push us again to imagine the future, even today, in such a critical and delicate moment, because, as Bevilacqua reminds us, 'today there is a special, deeper reason for recalling this history [of Venice and its waters] to the attention of our contemporaries. [...] Our present situation, our precarious relationship to dwindling resources, our environment that is steadily deteriorating and threatening us, all make us turn to Venice's singular past to a history that in a certain sense faced our own problems, centuries in advance' (Bevilacqua, 2009, p. 2).

Studying Venice, the lagoon and its islands today inevitably means having to deal with a long history of hydrogeological modifications and the social, political, and economic changes that have resulted from it. The Venetian lagoon, in fact, is a territory in which the work of man has produced a historicized environment capable of containing and assembling cultural and natural information over time and space.

It is common knowledge that some emerged areas were inhabited in pre-Roman times, but it is from the 15th century onwards that the hydraulic engineers of the Serenissima began to impose on the territory a model of conceptualization of space collectively supported by the proverbial idea that 'a great lagoon provides a great port'.[4]

In the 14th century, we begin to witness the material evidence of the great work of geographical modification that involved the entire drainage basin: the lagoon underwent a considerable process of burial caused by the large quantities of sediments introduced by rivers such as the Brenta, Bacchiglione, Dese, Muson, Zero, Sile, Piave (D'Alpaos, 2010a). The stretch of water, however, was an essential condition for the survival –not just commercial– of the population who lived there and had to be protected, safeguarded, defended. From the 15th century, the lagoon thus became an envi-

▸3 On the concept of disaster and on the difference between disaster and catastrophe see Bertin (2018).

▸4 The aphorism is attributed to Marco Cornaro [1285-1368] (Cessi, 1960, pp. 49–50).

ronmental monument controlled by a continuous, experimental, and incremental anthropic enterprise. An interminable series of interventions and hydraulic conjectures follow one another and freeze this territory.
The Venice lagoon is, by its nature, a mutable space, in transition between land and water and yet a constant maintenance work – from the great efforts of the Republic to the widespread micro-interventions of fishermen, millers and farmers– has supported the daily subsistence of an entire population for centuries. It can be said that the relationship between Venetians and the lagoon is traditionally risky and precarious. According to Bevilacqua (2009, pp. 20-21), in fact, 'choices had been made in the past –diverting a river, opening of a channel, enclosing a fish pen– and the present could begin to evaluate the effects. The previous decades and centuries, therefore, gave not just the proof –a submerged island, a filled-in swamp– of what Venice could become in a more or less near future. They also testified to human error or successful choices, displaying before the eyes of contemporaries the consequence of actions undertaken by their predecessors. [...] This is another reason why the Venetians could only have a strictly secular relationship with their history and an absolutely open-minded, empirical view of the present and the future'.
If, therefore, the lagoon is a palimpsest (Corboz, 1983) of permanent nature in which, in the last six centuries, man has imposed his own energy through a tangible system of regulation works, then its future will not only have to deal with projects and ideas in progress but, measuring itself with space, it will necessarily have to deal with all the projects and ideas that have been deposited there.

Methodological notes
The incessant process of regulation of the Venice lagoon has built up a geographical imaginary that has survived to the present day but has not been homogeneous and smooth. Indeed, it can be said with certainty that various moments of crisis have followed one another. These moments impose themselves in the history of the lagoon as occasions in which institutions and technicians –the first with the power to determine choices even on a large scale according to different models of conceptualization of space, and the others capable of materially implementing the modifications proposed by governments– initiate a series of 'debates on the fu-

ture'. In the past, those crises have produced an endless stream of projects, plans, inventions, weird ideas, illegitimate actions, and potential disasters. Some of these were in the process of being realized until shortly before they faltered and then finally collapsed and left room for alternatives.

In this regard, Bernardo Secchi wrote in 2004: 'whoever retraces the history of a city or a territory clearly grasps the periodical going out of its course from "legitimacy" and "necessity", from what could have been expected. The reasons can be the most diverse and it is often difficult to reconstruct them in convincing ways. This is precisely what opens the way to the attempt of hypothetical reconstructions of the course of history, reconstructions that help us to better understand current and future decision-making processes' (Secchi *et al.*, 2004, p. 21).

Urbanism, in recent decades, has trained us in 'what-if' as a critical tool of the project to represent potential, plausible and desirable futures. The construction of scenarios, visions and imaginaries has a fertile tradition: the 'what-if' responds to the need to visualize in the medium and long term, starting from contemporaneity, design choices that have vivid repercussions in space (Bozzuto, Costa and Fabian, 2008). The theorization and systematic development of scenarios is a relatively recent phenomenon. The military strategist and systems theorist Herman Kahn is commonly recognized as the father of scenario planning (Fahey and Randall, 1997) during his tenure in the 1950s at RAND Corporation. At the end of this period, he released *On Thermonuclear War* (Kahn, 1960), a treatise on the nature and theory of war in the nuclear age. Possibly the most celebrated and controversial nuclear strategist and among the founders of the Hudson Institute in 1961, Kahn believed in the necessity to address with his work not just specialists and military personnel. It is for this reason that he encouraged people to 'think the unthinkable' (Kahn, 1962), reflecting on possible consequences of a nuclear war that in those years seemed to be very close.

Kahn's insights into the benefits of using scenarios as strategic planning tools stretched further than military matters and scenario thinking began to emerge everywhere from politics and economics to public policy. A key experience in this sense is the one of Pierre Wack, head of scenario planning for Royal Dutch Shell in the Seventies of the 20th century, who contributed to

the creation of a more formalized approach to scenario thinking (Chermack, 2017).

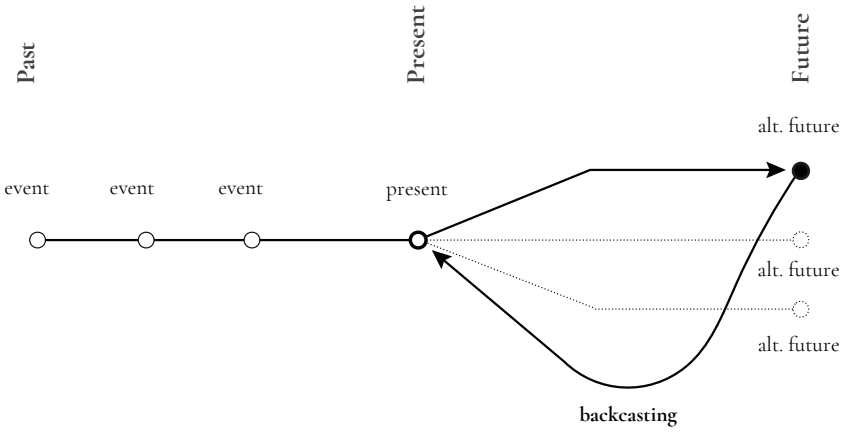
Stemming from the work of Kahn and Wack numerous approaches to scenario planning were developed, mainly in practice. This has led to a great diversity of methods and processes, and yet a clearly defined general approach that would result in a successful scenario planning still does not exist. Various typologies of scenarios have been suggested, without a consensus on them (Lena Börjeson *et al.*, 2006). This same variety seems to suggest that the ways of scenario constructing are very flexible and can be adapted to specific tasks and situations. Within this flexibility, it is important to set some boundaries and define how scenario planning differs from most other future-oriented approaches, such as forecasts, visions and simulations (Lindgren and Bandhold, 2009, p. 25). Scenarios usually provide a more qualitative description of how the present will evolve into the future, rather than requiring numerical accuracy. Scenarios differ from forecasts because they explore a range of possible outcomes resulting from uncertainty, while the purpose of forecasts is to identify the most likely paths and reduce uncertainty. Visions address a desired future, while scenarios –Kahn's work on thermonuclear war is a perfect example– engage also with undesirable events. A vision builds a picture of a desired future together with strategies for achieving the goals. Lastly, there are also simulations, systematic quantitative models of the future without the assessment of probability, possibility, or desire.

The variety in defining methods and processes to build scenarios is reflected also in the definition of scenario itself. A scenario is 'a set of hypothetical events set in the future constructed to clarify a possible chain of causal events as well as their decision points' (Kahn, Wiener, and Hudson Institute, 1968, p. 6), 'a means to represent a future reality with the aim of clarifying present action in the light of the possible and desirable future' (Durance and Godet, 2010, p. 1488), 'a hypothetical illustration of the future that describes a cross section in an established context, describes development paths and serves as a form of guidance' (Pillkahn, 2008, p. 165). The scenario definition that best matches with this research and the imagination of a future lake of Venice is 'a focused description of a fundamentally different future presented in coherent script-like or narrative fashion for better understanding

future uncertainties' (Schoemaker, 1993, p. 195). A definition that suggests how the development of a scenario is not only a planning tool but also an effective learning one, as it encourages an understanding of the development logic, clarifying driving forces, key factors, and actors. It is our belief that the adoption of the scenario tool for long-term planning and strategic foresight for Venice, its lagoon and metropolitan area, can facilitate a necessary adaptation to epochal challenges such as climate change and sea level rise, addressing key issues such as possibility, complexity, and uncertainty.

Counterfactual history

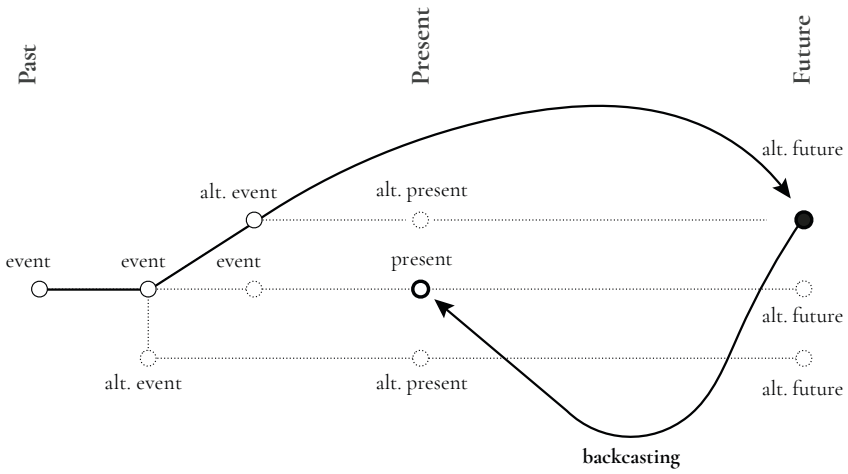
In addition to those placed in the context of the production of scenarios, there is a further question: 'what would have been the course of the urban history of a territory *if* ...' (Secchi *et al.*, 2004, p. 21). Thinking about the past –constructing a hypothetical alterna-



Backcasting Scenario
This diagram illustrates the relationship between past, present, and future through periodic events that define the urbanization of a territory. In this process, through a backcasting technique, the forecast desired in the scenario becomes normative, establishing a path that from the point of view of temporal logic proceeds from the future to the present.

tive– and talking about the missing present [or future], according to Secchi, is a way to undermine the deterministic conviction of historical events: 'a rethought story [...] avoids both conservative nostalgia of a narration dominated by the process of worsening, and the naively progressive one of a narration dominated by the process of improvement and its heroes' (p.21). This question, 'not very frequented, usually evaded or producing hasty and superficial answers' (p.21) inevitably intertwines and clashes with the discipline of historiography.

Counterfactual history, in fact, has been the subject of controversy among numerous historians, and various objections have accumulated over the last century. One of the first systematic efforts in the field of counterfactual history is that carried out in the 1960s by the historian and economic scientist Robert Fogel (1964) who applied quantitative methods to imagine the state of the US economy if the railways did not exist. Fogel's effort remained almost



Retroactive Scenario
The diagram illustrates the methodology with which some past and never realized projects (alternative events) are actualized to be projected into the future

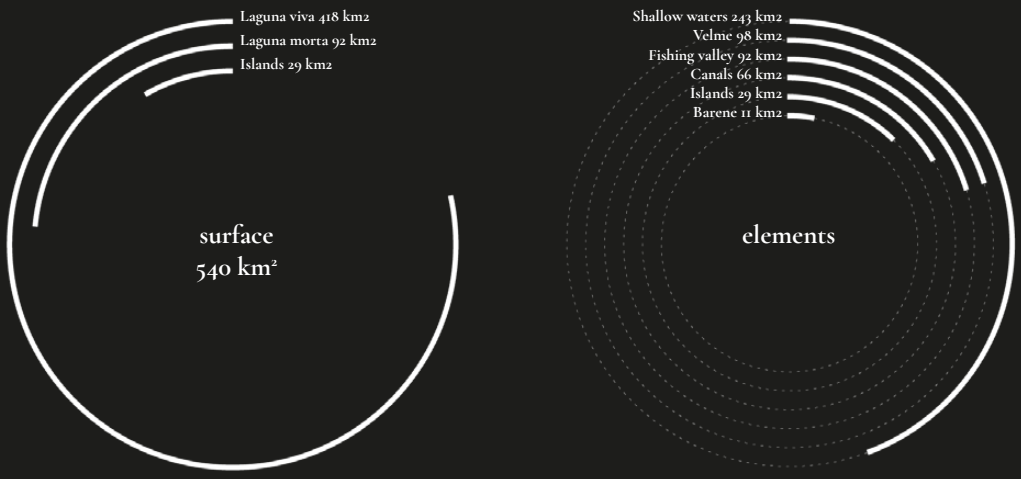
solitary until the early Nineties of the 20th century, when the texts –which investigated three different counterfactual scenarios– by the sociologist Geoffrey Hawthorn (1991) were published as well as the collection of essays *Virtual History: Alternatives and Counterfactuals* (Ferguson, 2011). A collection that provoked bitter reactions, including that of Edward Palmer Thompson, for whom counterfactual history is 'unhistorical shit' (Ferguson, 2011, p. 5), a mere exercise of the mind tied to the narrative. Yet, as Niall Ferguson points out, 'what we call the past was once the future; and the people of the past no more knew what their future would be than we can know our own. All they could do was consider the likely future, the plausible outcome. It is possible that some people in the past had no interest in the future whatever. It is also true that many people in the past have felt quite sure that they did know what the future would be; and that sometimes they have even got it right. But most people in the past have tended to consider more than one possible future. And although no more than one of these actually has come about, at the moment *before* it came about it was no more real (though it may now seem more probable) than the others. Now, if all history is the history of (recorded) thought, surely we must attach equal significance to *all* the outcomes thought about' (p. 86).

Starting from the arguments accumulated by counterfactual history in recent decades, from the reflections on the role of scenarios in the future to design the present and from the enormous amount of projects that can be discovered by studying the Venice lagoon in history, in this book we will try to explore a possible future for the lagoon and to put it in tension with a series of projects that have never been realized. In a nutshell, some lagoons designed and documented but never completed, or only partially built, will offer the opportunity to evaluate the legitimacy of a future scenario with the profound awareness that many design ideas have already accumulated (in the archives) and settled (in places) and that the current challenges, from tourist pressure, to economic crises, to health emergencies, to environmental degradation and the risks associated with climate change, are by no means unprecedented challenges.

What we talk about when we talk about the Venice lagoon?

The Venice lagoon, by its very nature, is a mutable space in transition between land and water, characterized by natural morphological structures, *barene*, *velme*, *ghebi*, whose rhythms and form are marked by the tidal cycle. However, it is also a "regulated lagoon", modelled by the incessant presence of man who has preserved over the centuries its equilibrium through drainage and reclamation, embankments and dams, canals, and humps.

1. laguna *(noun)* di Venezia *(noun)*



Surface and elements of the lagoon
Source of data: CORILA, Consorzio per il coordinamento delle ricerche inerenti al sistema lagunare di Venezia, 2021.

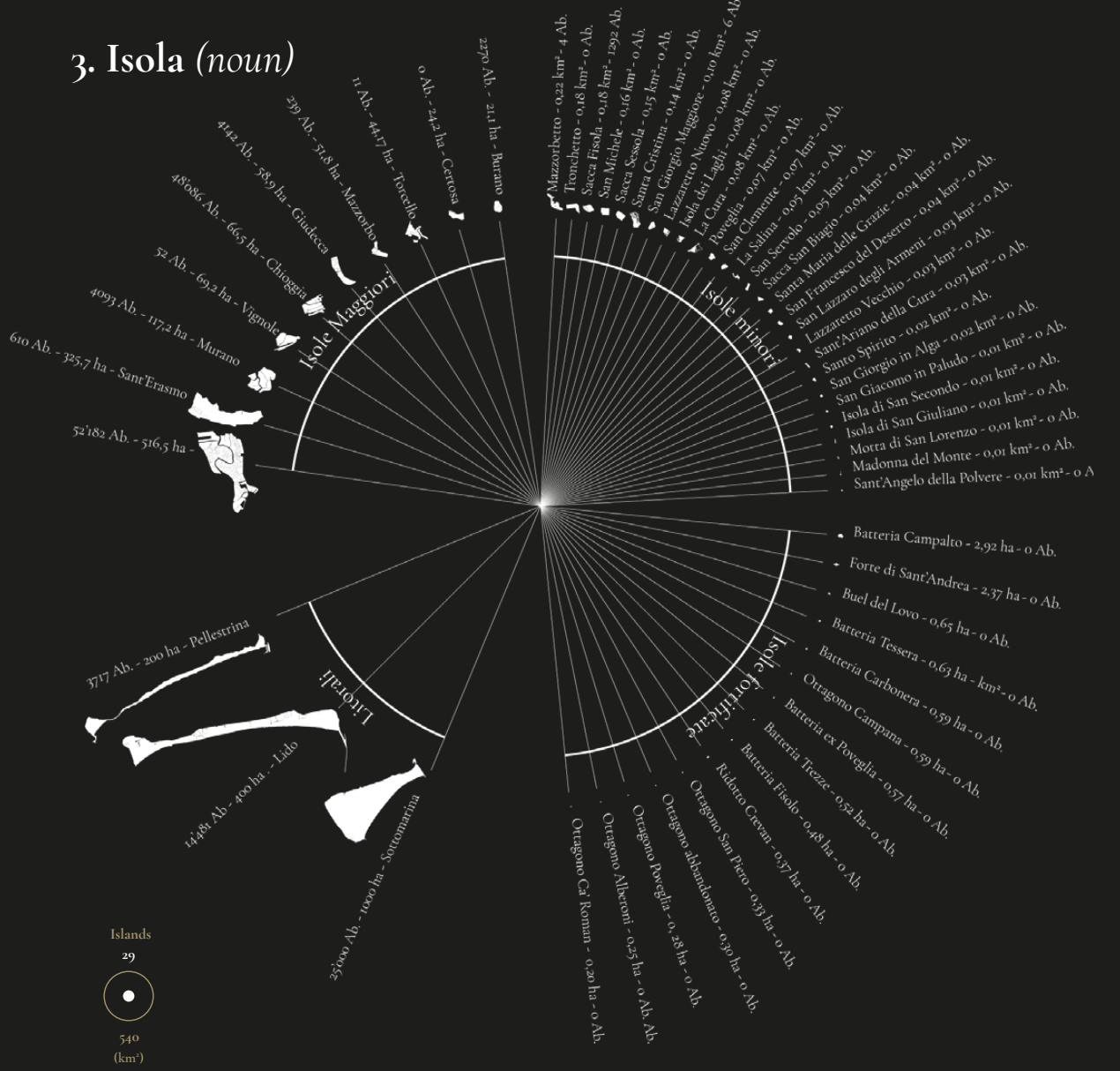
Venice *(noun)* lagoon *(noun)*
The Venetian lagoon –an enclosed bay with a surface area of around 550 square kilometres– is the largest wetland in the Mediterranean basin. Formed about six to seven thousand years ago, it is the most important survivor of a former system of estuarine lagoons stretching over the entire North Adriatic Sea.

2. **laguna** *(noun)* **viva** *(adj.)* / **laguna** *(noun)* **morta** *(adj.)*

Living and dead lagoon
In white the *dead lagoon*, the areas whose sediment residence times are between 12 and 100 days.
Source of data: ISMAR, Istituto delle Scienze Marine, 2014.

living *(adj.)* lagoon *(noun)* / dead *(adj.)* lagoon *(noun)*
Laguna viva is the living lagoon, the part which is closest to the mouths and most actively reciprocated by tidal currents. Here some areas are always submerged, while others are periodically submerged during high tides. *Laguna morta* is the dead lagoon, the part hydraulically and geographically decentralized with respect to the mouths located towards its mainland edges. The dead lagoon is separated from the living one by the bands of *barene*.

3. Isola *(noun)*



island *(noun)*
Area of land entirely surrounded by water. The large majority of islands of the Venetian lagoon are the result of the work of man who stabilized the ground and the edges starting from islets or sandbanks. The remaining islands are completely artificial or of natural origin.

Islands of the lagoon
Counterclockwise: the coasts, the major islands, the minor islands, the fortified islands.
Source of data: IDT-RV 2.0, Infrastruttura Dati Territoriali della Regione del Veneto, 2021; ISTAT, Istituto Nazionale di Statistica, 2021.

4. canale *(noun)*

Channels of the lagoon
In white the canals, in gold the *conterminazione lagunare* (juridical and administrative border of the lagoon).
Source of data: CORILA, Consorzio per il coordinamento delle ricerche inerenti al sistema lagunare di Venezia, 2021.

Canals
66

540
(km²)

0 2,5 5 10 km

canal *(noun)*
Lagoon waterway of considerable width, wider than those of a *rio* or a *ghebo*. The channels of the lagoon can be natural or artificially excavated. Some of the main lagoon channels, like the Grand Canal, coincide with the paleo-beds of ancient rivers.

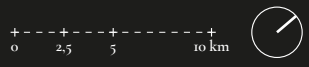
5. **barena** *(noun)*

Barene
In white the barene, in gold the *conterminazione lagunare.*
Source of data: CORILA, Consorzio per il coordinamento delle ricerche inerenti al sistema lagunare di Venezia, 2021.

salt *(adj.)* marsh *(noun)*
Physical structure among the most characteristic of lagoon environments, it appears as a flat and low plateau, consisting of silty-clayey sediments, generally covered by halophilous vegetation. The sandbanks are located at intermediate altitudes between the islands and the mudflats. They normally have emerged, and are submerged during the syzygy tides, that is, during the full moon and the new moon.

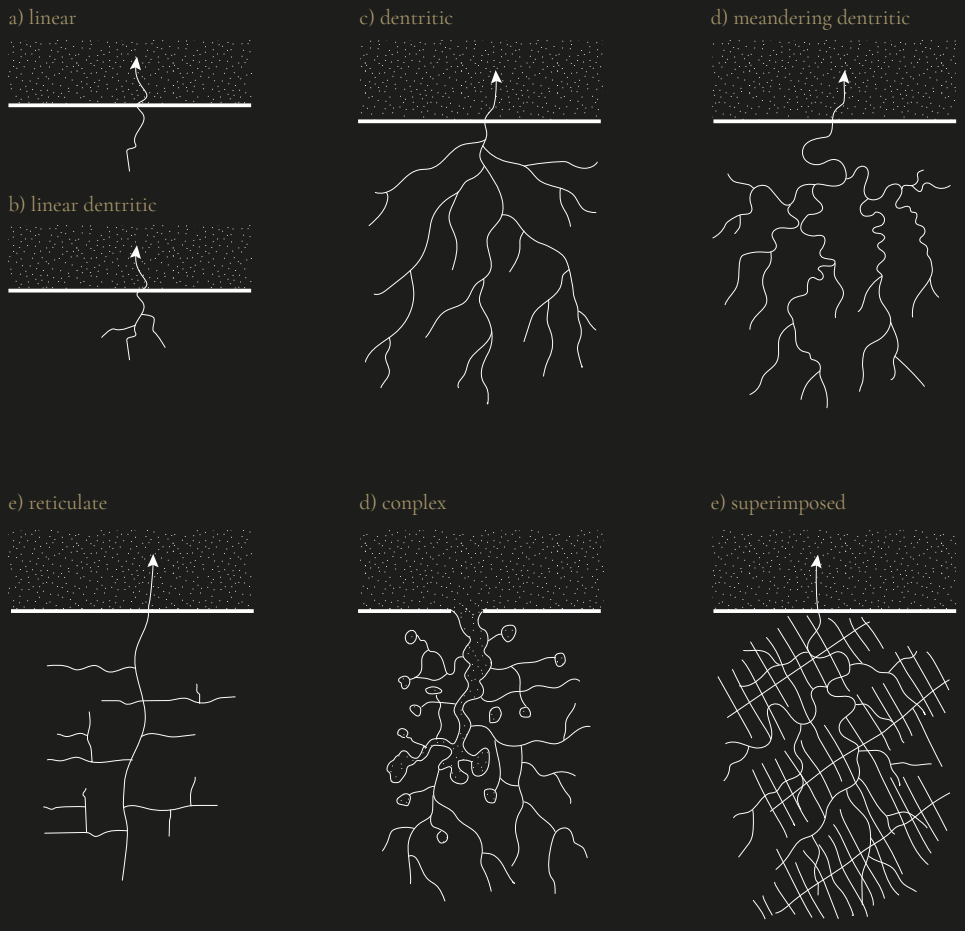
6. velma *(noun)*

Velme
In white the *velme*, in gold the *conterminazione lagunare*.
Source of data: CORILA, Consorzio per il coordinamento delle ricerche inerenti al sistema lagunare di Venezia, 2021.



marsh *(noun)* flat *(adj.)*
Portion of the lagoon bottom that remains submerged in normal tide conditions and emerges only with low syzygy tides. The *velma* is a habitat for European species that can withstand significant environmental variations –from salinity to oxygen dissolved in water and temperature– due to periodic and repeated surfacing.

7. ghebo *(noun)*

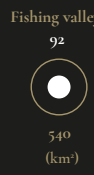


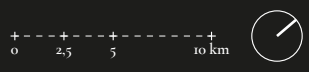
Abacus of *ghebi*
Different types of distribution of *ghebi* (from Allen, 2000).

tidal *(adj.)* creek *(noun)*
Small channel with a winding course that cuts through the *barene* and *velme*, connecting the innermost areas of the lagoon with the deeper canals.

8. valle *(noun)* da pesca *(noun)*

Fishing valleys
In white the fishing valleys, in gold the *conterminazione lagunare.*
Source of data: CORILA, Consorzio per il coordinamento delle ricerche inerenti al sistema lagunare di Venezia, 2021.





fishing *(noun)* valley *(noun)*
Lagoon area artificially separated from the open lagoon by a fixed fence made up of poles or alternatively by embankments. These are shallow pools of water used for breeding fish that are raised and then captured through devices that hinder their natural movement towards the open sea.

1_dead lagoon_august2021

3_dead lagoon_august2021

Pigs on the Wing

Some recent events that took place between November 2019 and December 2020 have brought the 'Venice question' back to the centre of world attention. On 12 November 2019 the high water hit Venice with exceptional and devastating force. With sirocco winds of up to 120 kilometres per hour and a tidal peak of 187 centimetres, the flood, second only to the '*aqua granda*' (great water) of 1966, struck violently across the coast and the lagoon, uprooting trees on the shores, lifting *vaporetti* and boats, killing two elderly islanders in Pellestrina, flooding houses, restaurants, churches, 96 percent of the surface of the historic centre, submerging the priceless heritage of the crypt and basilica of San Marco with incalculable damage. While citizens and shopkeepers try to repair the damage, in the following days three other exceptional tides hit the city (13 November 2019: +144 centimetres; 15 November 2019: +154 centimetres; 17 November 2019: +150 centimetres): such a persistence of the phenomenon had not been registered since 1872.

Eleven months later, on the morning of Saturday 3 October 2020, some 17 years after the start of the works, on the occasion of a strong disturbance on the lagoon with tide forecasts exceeding 130 centimetres, the MoSE (Electromechanical Experimental Module) successfully comes into operation, thanks to the coordinated action of 80 officials, technicians, and workers. The global media show unreal images of the huge yellow bulkheads that in sequence, like the famous flying pigs of *Animals*, rise slightly from the sea to protect the city. Despite the enormous operating costs calculated at 323,000.00 euros at each closure, this time and perhaps forever Venice seems to be safe. No high water phenomena occurred. Life, commerce, and tourism can return to swarm through the streets and squares of the island 'for overgrown children who are still capable of dreaming' celebrated by Braudel (1987, p. 243). Just five months after the high water of November 2019, a new emergency strikes the city: the lockdowns of March and September 2020 once again evoke the images of a ghostly Venice, the scenes of clear waters spread around the whole world, and the deserted streets and canals highlight other and perhaps deeper weaknesses. In the meantime, doubts are increasingly being raised about the long-term effectiveness of the MoSE, in relation to the huge manage-

ment and operating costs and the changed tidal conditions that will result from climate change. Once again Venice must question its fate as a transitional lagoon environment artificially frozen by human action. As in fact it was already clear in the 18th century and perhaps from the time of Sabbadino 'if the lagoon tended to silt up because of natural processes [...] now it was being threat-

ened by a much more serious and opposite phenomenon: the rise in the level of the sea; or perhaps more accurately, the slow but relentless sinking of the whole territory of Venice [...] it was precisely this condition that moved Filiasi to say, "if this goes on, in a few centuries it will surely be necessary to rebuild Venice on top of herself" (Bevilacqua, 2009, p. 15). To paraphrase Roger Waters, perhaps it is really true that Venice, like men, will change for the better only when pigs will fly.

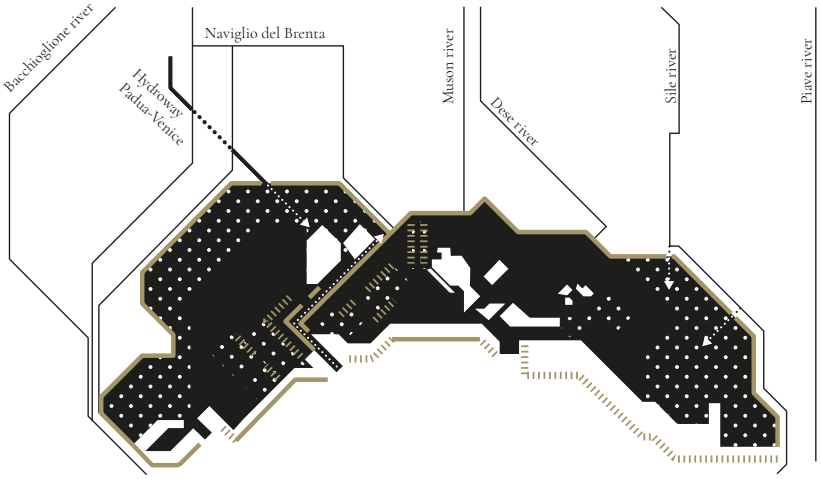
Two scenarios

The concurrence of the exceptional events mentioned above has prompted the community of scientists, operators, and citizens to look again at the challenges for the protection of Venice and its lagoon, and to map concrete scenarios for its evolution where, precisely following the November 2019 flood and at the entry into operation of the MoSE, various ideas about the lagoon are piling up in the local technical debate. Following the various special laws for Venice, the recent disastrous high tides and doubts about the effectiveness of the movable bulkheads in relation to the average sea levels expected with climate change, the issue of safeguarding has become increasingly pressing: also in the local debate there emerges, on the one hand, the collective need to protect the lagoon and its hydraulic functioning; on the other hand, that of preserving the immense historical and artistic heritage deposited in Venice and in the other historical islands.

Looking at current environmental pressures and medium and long-term climatic changes, there are two main scenarios that scholars of the equilibrium of the lagoon and the conservation of the immense historical-artistic deposit of the islands are addressing. The first looks at the lagoon as a territorial heritage stratified over the centuries and sees in Luigi D'Alpaos the main representative, aiming to preserve its equilibrium and ideally following in the steps of the design rationalities that were embodied by Cristoforo Sabbadino since the time of the Serenissima. A scenario that implicitly responds to the hypothesis *'if we want to preserve the equilibrium of the lagoon, then...*' and, in this sense, seeks to '[...] restore centrality to safeguarding lagoon preservation issues as it happened at the time of the Republic when Cristoforo Sabbadino, the most famous of the ancient hydraulic engineers who worked in its service, managed to impose his ideas in this regard' (D'Alpaos, 2010b, p. 13). The hypothesis is developed in some reflections and graphic schemes by D'Alpaos in *Fatti e Misfatti di Idraulica Lagunare* (*Facts and Misdeeds of Lagoon Hydraulics*) which concern the re-introduction of sediments into the lagoon to counteract the erosion of the seabed caused in particular by the Canale dei Petroli (*Petroli Canal*) and the contextual reconstruction of significant areas of the *barene* (D'Alpaos, 2010a, pp. 275–318). The greatest amount of sediment would be carried through the Padua-Venice waterway in conjunction with the floods of the Brenta.

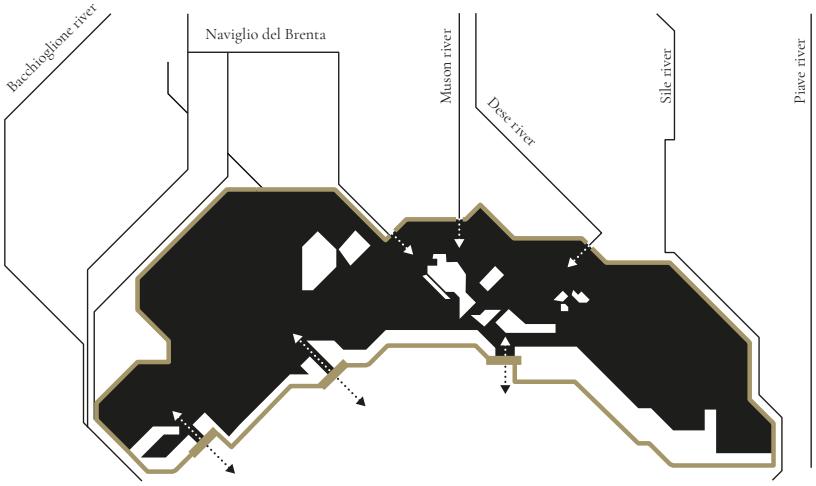
D'Alpaos envisages the construction of a discontinuous embankment along the *Petroli Canal* and along the Vittorio Emanuele III canal in the central lagoon, and lighter and reversible technologies to favour the terraforming of morphological structures useful for reducing the impacts of wave motion along the main waterways, at the same time maintaining the protection system of the shores. In this setting, Luigi D'Alpaos supports the extreme urgency and need to continue to perpetuate the care and maintenance of the lagoon: this is an immense territorial heritage in which natural and anthropic information is assembled. Although with different outcomes, the scenarios proposed by Luigi Bonometto also move on the line of environmental and morphological restoration for the rebalancing of the central lagoon. Bonometto suggests the re-burial of the *Petroli Canal* and the restoration of the hydraulic and navigation functions of the Fisolo canal, the terraforming of mudflats and sandbanks to protect the landfill coffers and submerged bumps to contain the turbid waters (2017). These are the scenarios that are inspired by the principles of 'experimentation, gradualness, and reversibility', established by the Special Law on Venice for interventions to protect the lagoon[►5].

►5 Special Law for Venice n. 798 of 29 November 1984 'New Interventions for the Safeguard of Venice', Art. 3 point a)



Equilibrium conservation scenario
The diagram illustrates the future interventions proposed by Luigi D'Alpaos for the conservation of the hydrodynamic equilibrium of the lagoon; in dashed gold on a black background, the morphological structures between the central lagoon and the southern lagoon; the sea protections in gold on a white background; in black dotted lines the introduction of new sediments through the Padua-Venice waterway, which assumes the function of a spillway channel when the river Brenta floods.

The second scenario, advanced mainly by two CNR-ISMAR researchers, the German oceanographer Georg Umgiesser and the Venetian biologist Davide Tagliapietra, is apparently opposite to the previous one and responds to the hypothesis: '*if we want to safeguard Venice and its historical and artistic heritage, then…*'. It looks at the closure of the entire lagoon as the only possible long-term design choice, capable of guaranteeing the protection of Venice and the other historic islands from the rising phenomena that are derived from climate change, effectively proposing the ideas of separation from the sea that in the 16th century were supported by Alvise Cornaro (Umgiesser, 2016, 2020; De Marchi and Iuorio, 2021; Lionello *et al.*, 2021). According to the mathematical models considered by Umgiesser, by the end of the century global warming will lead to a rise of the Venetian sea level of at least 50 centimetres or more, with the consequence of an almost constant closure of the movable bulkheads of the MoSE to defend the lagoon. If for the protection of the lagoon we can easily act on the causes of endogenous phenomena –wave motion, loss of sandbanks, erosion and loss of sediments, water pollution– little or nothing can be done to counteract exogenous phenomena of planetary scope, such as those of the rising waters deriving from climate change that threaten the very existence of Venice and the historical islands. To safeguard Venice and the mainland, by 2100 the only solution would be the closure of the entire Northern Adriatic system through a sea wall and double dike, and the complete deviation of the rivers outside the lagoon. In the long run, climate change will sooner or later put us in front of an inevitable choice, in which the futures of Venice and the lagoon are destined to separate, where to save one it will be necessary to sacrifice the other. For the CNR researchers, closing the lagoon does not necessarily mean allowing it to die, but orienting it to a new ecological balance, looking at the narrow and fluvial lagoons and coastal lakes. The hypothesis recognizes the usefulness of the MoSE which, even if ineffective in the long term, allows to gain time for the progressive adaptation of the lagoon to become a lake according to a three-phase process: the first aimed at reducing aquatic pollution, the second aimed at providing the city with an efficient sewage system, the third aimed at the ousting of the industrial and tourist port. Naturally, the project of a coastal lake with few exchanges with the sea has cascading consequences that involve rigid systems



Lagoon closure scenario
The diagram illustrates a hypothetical complete closure of the lagoon starting from Georg Umgiesser's observations on the safeguarding of Venice and the other historical islands from the sea rise expected by 2100, when the MoSE will no longer be sufficient; in gold the new embankments and the works at the lagoon mouths.

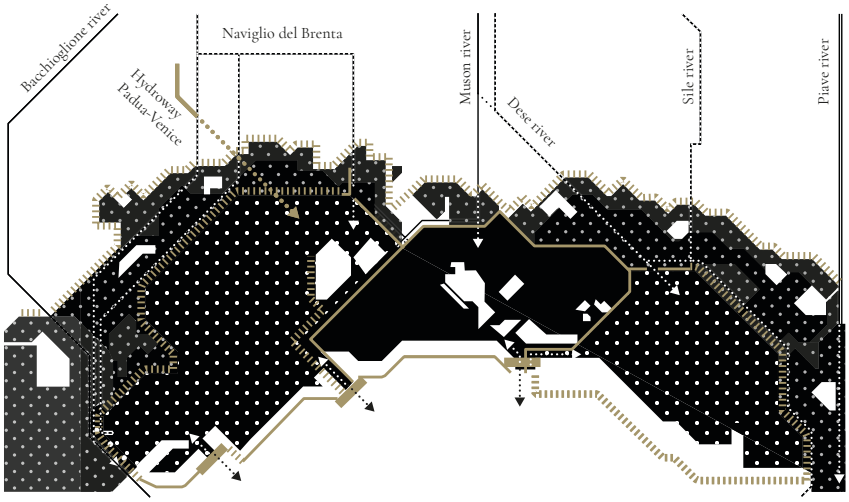
of control and purification of the water, and a transformation of the biological system that today characterizes the lagoon.
If D'Alpaos looks at the lagoon as a monument in itself, a territorial heritage that 'exists as a co-evolutionary historical construct, the result of reifying and structuring anthropic activities that have transformed nature into territory' (Magnaghi, 2010, p. 96), Umgiesser looks to the safeguarding of Venice as an unavoidable mission to deliver to the future that 'city both unreal and real' (Braudel, 2005, p.244), made of buildings, praised by history. If in the long history of Venice the theme of safeguarding the historic island was intrinsically connected to the safeguarding of its lagoon –a great lagoon provides a great port–, today the scenarios of Umgiesser and D'Alpaos push us to reflect on an unspeakable choice, where to save Venice it seems necessary to sacrifice its lagoon or vice versa. This choice essentially pushes us to reflect on the very idea of heritage and, more generally, on the territory as a renewable resource (Viganò, 2013).

Three lagoons

In reality these scenarios tend to assume the lagoon (and the strategies underlying its protection) as a homogeneous space. However, it seems to us that it is possible to put forward an intermediate hypothesis that responds to the hypothesis: '*if we separate the*

lagoon into several parts, then …'. Together with the students of the bachelor's degree in architecture at the Università Iuav di Venezia[▸6] we tried to develop a scenario of separation of the central lagoon for the constitution of a closed lake –the lake of Venice– where the historical islands are located. All of this maintaining and strengthening the northern and southern great lagoons in their conditions of amphibious and osmotic spaces, radicalizing the biological, hydraulic, and practical differences that already characterize the water surface of the Venice lagoon. The scenario draws a lake with impermeable edges to safeguard Venice and the other historical islands –a water and metropolitan space for trade and mass tourism– and two lateral lagoons. The latter ones are intended as sanctuaries for biodiversity and to keep alive the osmotic relationship with the sea and drainage basin, intended for perpetuation of those practices and landscapes related to fish farming and 'slow' tourism that still survive in these areas today. A more extreme and perhaps more distant alternative in time envisages after 2100 the shutdown of the water pumps –made necessary by the exhaustion of fossil fuels– and the extension of the northern and southern great lagoons towards the neighbouring

▸6 Scenarios of the lagoon (Academic years 2018-2019, 2019-2020, 2020-2021), design studio of the bachelor's degree in architecture of Università Iuav di Venezia; Prof. L. Fabian; teaching assistants C. Cangiotti, L. Iuorio, G. Magnabosco, G. Mantelli, I. Visentin.



Three lagoons scenario
The diagram illustrates a hypothetical separation of the central lagoon and expansion of the lateral lagoons by 2100; the new rigid embankments continue in a gold solid line, while the soft separation infrastructures (dunes and sandbanks) are dotted.