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Rethinking water management through a
long-term sustainable and holistic strategy.
Valorizing UNESCO sites in Italy and Germany

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When I am working on a problem,
I never think about beauty.
I think of only how to solve the problem.
But when I have finished,
if the solution is not beautiful, I know it is wrong.

Buckminster Fuller, 1895-1983

I dedicate my thesis, and all the related efforts,
to my loved ones who have recently passed away
and to those who fortunately are still here.
I also wish to thank my supervisor and co-supervisor,
always able to give me the best pieces of advice.

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Abstract

This work aims to demonstrate that, as the environment represents the biggest challenge of our century, more studies and investments on that topic should be undertaken as soon as possible. This awareness arises not only from the desire to preserve our world but also from the need to develop our society more sustainably, promoting a change for many realities.

After an introductory explanation of the environment's illness on a global level, the work will focus on one potential element that might improve this transformation: water. Even if a lot has been written on this liquid, there is still not a concrete holistic vision that considers all the different facets of its rich potential for the economy, as well as for culture and society. Such a vision would allow us to improve our humanistic, scientific, and international realities with knowledge and tools available today, but merely a few years ago still underestimated. This analysis will deal with three main arguments that concern a reborn use of water regarding arts, culture, tourism, and education firstly, politics, finance, economics, and technology secondly and society thirdly. This reflection will show how many benefits and positive externalities such a reevaluation of water-related potential would bring for everyone. This point of view will be reinforced before with a general overview, comparing nine Italian and German UNESCO sites that have to do with water and then with two other cases that make water their main feature for being part of the UNESCO heritage, that are Venice and Augsburg. The aim is to evaluate these two different systems, considering the main strengths, weaknesses, opportunities, and threats to water use. These assumptions will clearly reaffirm the importance of water in this century, especially for Europe that dreams to be a worldwide protagonist in the environmental challenge, while the USA and China are interested in other areas almost unrelated to sustainability. In the end, more ideas and projects will be proposed to show how many possibilities could be explored in the incoming future.

Keywords: Water, Sustainability, Environment, Culture, Economy, Society, UNESCO, Italy, Germany.

Introduction – The greatest contemporary world challenge: the environment

The relationship between humans and the environment is likely to be one of the oldest yet it represents one of the most modern topics in our history. Looking at the current situation of the Earth, critical issues emerge far too clearly, from pollution to global warming, from deforestation to natural disasters. Therefore, the obvious question is: how did we get to this point? The answer to this question could be found by looking at history and in particular to our development as human beings. The relationship between humans and the environment is not one-way: not only the environment influences men, but we also influence nature through our activities. Man has always modified his surroundings for the sake of human development. This process slightly started from the creation of tools for hunting, or cave painting in the Palaeolithic, passing through agricultural activities in the Mesolithic, till the construction of the first cities and the exploitation of land for agricultural and commercial purposes during the Neolithic and the metal ages. Then the Greek and Roman period came, with more concrete examples of environmental impact such as the deforestation to build triremes, or urbanization issues in Imperial Rome, the first city in history to exceed one million inhabitants. In the past, human intervention has sometimes been so strong to cause major natural upheavals, with repercussions on humans themselves. The anthropologist Diamond strongly focused on this topic and dedicated an entire book to explain the decline of ancient peoples such as the Polynesians, Native Americans, and Maya. This decline was not only due to social reasons, but also and especially to environmental reasons such as habitat damage, population growth, and climate change, regardless of neighbours' relevant clashes (Diamond, 2011). Nonetheless, the system was able to maintain a certain balance worldwide, which remained stable until the First Industrial Revolution. The reasons for this initial balance are mainly three. Firstly, ancient knowledge was simpler, and based more on subsistence and limited production rather than large-scale production. Secondly, nature was almost seen with sacred respect, therefore man tried to tame the environment at most, to make it more liveable, rather than completely distorting it for utilitarian purposes. Thirdly, and this may be the most important reason, before the First Industrial Revolution there was never such a remarkable world population growth to justify an excessive exploitation of nature. Indeed, many plagues, famines, and local wars in history limited a sharp increase of the world population until the end of the eighteenth century (Diamond, 2014)¹.

The turning point in history was the Enlightenment, when science and technology were intended as means of domination over the forces of nature, together with the First Industrial

¹ With his last essay, Jared Diamond won the Pulitzer Prize for non-fiction in 1998.

Revolution. From that moment on, the balance in the relationship between humans and the environment started to deteriorate. Human beings began to massively exploit the environment, especially for industrial production, employing water and soil, together with the indiscriminate work of men, women, and even children, for a single purpose: profit. This is the highest motivation that has driven the economy and human society over the last two hundred years, under the rules of production and consumption. In this way, great goals and innovations were undoubtedly achieved, as the Enlightenment strongly hoped for, but nature was incredibly disfigured. Furthermore, medical advances and an improvement in the quality of life in the Western developed countries led to the so-called demographic revolution: the death rate dropped dramatically, and a simultaneous high birth rate led to a doubling of the world population in two centuries (American Museum of Natural History, 2016). This new geological era has been called the “Anthropocene”, a term first adopted by the Dutch Nobel Prize Paul J. Crutzen in 2000². The scientific community, however, has not yet identified a univocal start date for this period, evaluating several options such as the invention of James Watt’s steam engine in 1784, as suggested by Crutzen himself (Steffen et al., 2007). Ultimately, history shows that in just two hundred years mankind has managed to upset the environment more than in the rest of history.

Fortunately, this troubling situation has begun to change almost half a century ago, when the environmental challenge started to be perceived as a very sensitive topic globally, increasingly entering political, financial, and cultural debates. Starting from the early seventies, the traditional economic development model was subject to a strong neo-Malthusian criticism. This perspective is based on the assumption that the Earth is unable to meet the needs of an exponentially growing humanity. This critique was strongly supported, especially by the biologist Ehrlich in his book *The Population Bomb* (1968) and by the relevant study *The Limits to Growth* by the MIT University of Boston (Meadows et al., 1972). On this ground, the first conference ever on the human environment was held in Stockholm in 1972. It was immediately clear that this meeting could represent a new important starting point for all humanity, bringing hope for a better future. Moreover, the 1973 oil crisis gave the Western countries a concrete opportunity to think about clean alternatives to limit pollution. These hopes, however, became more realistic only twenty years later, with the Earth Summit in Rio de Janeiro (1992) for a sustainable development of the 21st century. Here, for the first time, the focus was on topics such as climate, air pollution, respect for all cultures including indigenous people, alternative energy sources,

² The term “Anthropocene” was actually introduced in the eighties by the biologist Eugene Filmore Stoermer, but it was Crutzen who better formalized the concept.

and a better use of water intended as a scarce resource. At the end of this Conference, five fundamental documents were adopted, setting the future guidelines for global action: the *United Nations Framework Convention for Climate Change* (UNFCCC); the *Convention on Biological Diversity*; the so-called *Agenda 21*; the *Rio Declaration on Environment and Development*, and lastly the so-called “Forests Principles”. In the next thirty years, many other conferences annually followed this first meeting, often producing better and better results year after year. It is worth mentioning for their impact the conferences of Kyoto (producing the *Kyoto Protocol* in 1997, later ratified in 2005), Johannesburg (2002), Montreal (2005), Bali (2007), Copenhagen (2009), Cancun (2010), Doha (2012), Paris (2015), and the latest one in Madrid in December 2019.

Alongside these official climate-centred conferences, transversal committees and research have contributed to the creation of a new global ecological culture. This has strengthened the link between the environment and multiple fields of study such as biology, art, culture, economy, sociology, architecture, and many others. Famous historical organizations such as UNESCO witness this tendency but also more recent institutions such as the “Italian alliance for sustainable development”, called ASviS³, born in 2016. There are also smaller organizations able to promote an integrated involvement privately. Considering the field of study of who is writing, the “Climate Heritage Network” deserves to be mentioned as well. It is an international network created in 2018 to bring together artistic, cultural, and social organizations in achieving the objectives set by the Paris Agreement in 2015. Their main slogan underlines this approach: “Cultural Heritage is a Climate Action Issue. Climate Action is a Cultural Heritage Issue” (Climate Heritage Network, n.d.)⁴. And this is only the beginning of a wider global change, still waiting for some concrete public and private opportunities to put these ideas into action.

Given the historical contextualisation illustrated in the previous paragraphs, it is undeniable that the perception of the importance of the environment underwent a significant acceleration, the environment being today one of the greatest concerns for the future. This awareness has recently resulted in a series of initiatives. There are numerous examples to cite. For sure, we need to mention the “Fridays for Future” movement, born as a collective protest of young students in 2018, thanks to charismatic figures such as Greta Thunberg. Even public characters, who have not a direct connection with the environment, personally took the field for a cause they felt was right. Leonardo di Caprio’s speech in favour of the

³ Link to the official website: <https://asvis.it/>

⁴ Link to the official website: <http://climateheritage.org/>

environment at the 2016 Oscars is a vivid memory in our minds (Stevens, 2016). Another example comes from one of Pope Francis' most important encyclicals, *Laudato si*, which focuses on this topic. This document is particularly important because it is the first time that the Catholic Church has published an official dissertation on the issues of the environment and its protection, addressed to everyone, even non-Christians (Bergoglio, 2015). Despite all these initiatives, not everyone shares the idea that protecting the environment is not just a secondary battle. It is the greatest challenge of our time, as the Italian President Mattarella defined it before the climate conference of Katowice in December 2018 (Mattarella, 2018). This evidence emerges also from a small analysis comparing the environmental crisis and another one that has been upsetting us for months, the Coronavirus pandemic, emphasizing how decisive the first one is, as well as the correlations between the two crises.

In the Covid-19 crisis, the enemy is an unknown virus with some detectable characteristics, which was initially underestimated and then fought hard. Although the danger has not vanished, the first step to contain this virus was to recognize the strength linked to its high transmissibility and, thanks to the work of experts, try to contain its spread as much as possible, not having the weapons to defeat it. Each and everyone of us has contributed to this mission, some by working in hospitals, others by staying at home, changing patterns and lifestyles for a greater purpose. An increased national and international collaboration was especially necessary to reduce travel and commuting, as well as to add greater funds to health care and research. In this terrible and unpredictable situation, human beings have demonstrated to be resilient, capable of adapting to the most unexpected situations in order to survive. Furthermore, the role of public institutions in managing this emergency has been fundamental, obtaining a result that the abstract "market" could not fulfil (Van Barneveld et al., 2020). All these aspects have many correlations with the environmental challenge. As it happened at first for Covid-19, even environmental claims had been underestimated by many States and people, since the first conferences dating back to the 70s. Furthermore, environmental disasters affect human beings in a non-homogeneous and mostly unpredictable way, just like Coronavirus. Even to safeguard the Earth everyone of us is called to do their best, as it happened for the pandemic. Surprisingly, there is even a positive correlation between these two different types of crises, as numerous reports show. This is the case of Ebola and Marburg haemorrhagic fever (in the 70s), and diseases caused by other species of Coronavirus such as MERS and SARS (from the 2000s). Destroying ecosystems means losing the natural barriers between us and viruses. So, the more men will enter these regions for reasons of agriculture, mining, forestry, or urban planning, the more easily they will come into contact with and be infected by isolated species within their

natural environment. This phenomenon is called zoonotic spillover (Quammen, 2012). Even pollution seems to influence this spread (Alessi et al., 2020). Said that, there are also deep differences between these two crises. What most people miss in the Coronavirus crisis, and the main reason why the environmental crisis could be worse in the long term, is that there is not a well-defined turning point as for the spread of the cases of Covid-19. These two crises move, in fact, at different speeds. Covid-19, the most recent crisis, causes panic in the present, as it has suddenly disrupted daily life with sickness and death in rapid growth. The other and older crisis, instead, causes concerns for the future but not so much in the present because it does not touch us every day. Thus, we cannot immediately see that the risk is so concrete that we do actually need to stand united as for Coronavirus (Pasotti, 2020). Revkin, the author of a prophetic book on global warming in 1992, says that this is one of the characteristics of the climate emergency: it is measured like “dripping”, while hurricanes, earthquakes, and viruses are hard and clear blows (Revkin, 1992). Indeed, every day we can hear on television or read in newspapers (see the following image) that air and water are increasingly polluted or that glaciers are melting day by day, but we still ignore these visible events and data, always focusing on daily problems.



*Figure 1 - Ipsos: Climate is scarier than Covid
Source: Greenreport.it - Year: 2020*

The present time, full of changes due to Coronavirus, may represent the right moment to introduce new models and ideas for the future, once the crisis will be over. For sure, this development must be both top-down and bottom-up. Most human beings should abandon their erroneous conceptions of the progress of the economy and society. For more than seventy years, the GDP has quantitatively defined work, driving the choices of all the players in the global economy. This index, however, does not consider qualitative aspects

such as environmental externalities, “informal” activities such as volunteering, caring for people, and working in families, as well as the ecosystem services that nature provides for free to human societies. This causes significant distortions, leading politicians and economists to make bad decisions (Fioramonti, 2019). Therefore, the GDP model should no longer be our absolute reference. Other elements need to be considered, as proposed by the Human Development Index (HDI) or by the Index of Sustainable Economic Welfare (ISEW) (Pasotti, 2020). The first one was developed by the Pakistan economist Mahbub ul Haq in 1990 and consists of the geometric mean of three basic indices: life expectancy, level of education, and income. This model is still taken into high consideration by the UN but it is not enough. The second index, maybe less successful than the previous one, was proposed one year before the HDI by two researchers, H. Daly and J. B. Cobb, and it appears to be better than the other two models – the GDP and the HDI – especially from an environmental point of view. Indeed, it measures sustainable economic well-being by considering the link between the environment, the economy, and society. Consumption costs are correct with many factors such as the distribution of income and the deterioration or valorisation of natural resources. Free time is also emphasized by assigning it a certain economic value, as well as it happens for unpaid domestic work, school and university studies, and volunteering (Marro, 2016).

Thanks to all these combined efforts and interests, even the concept of sustainability will undergo substantial changes in the future, as it happened in the past. At first, in the eighties, sustainability was just conceived as the optimal intersection between human, economic and environmental capital, as suggested by the Brundtland Report in 1987 (WCED, 1987). Only since the nineties, this conception has changed, presenting itself as three concentric circles starting from the smallest economic capital, then moving towards the larger social circle, and concluding with the biggest environmental one. In this way, the environmental capital achieved a primary role. Finally, since the beginning of the new millennium, the cultural factor, intended such as creativity and diversity, began to be highly considered, together with a more marked ethical attitude. Therefore, the evolution we evoke should just be the continuation of what is already happening thanks to greater studies, funding, and international agreements (Pranovi, 2020). This approach could be the right start to develop an inclusive and holistic vision of sustainability to fight the environmental crisis. In the future, a stronger bottom-up approach in this direction will prevail through culture, art, and tourism, reinforced also by a top-down vision through politics, finance, and economy. Regional, provincial, and citizen bodies will also play a strategic role in the middle by

promoting virtuous practices especially in the agricultural, industrial, energetic, communication, and social fields (HIA21 Project, 2015).

The present work will deal with all the aspects above mentioned, focusing mainly on water, which is probably one of the elements we will need the most, yet at the same time one of the most affected by the environmental crisis. The latter aspect will be explained in depth in the following chapters, also presenting some case studies from Italy and Germany.

Chapter 1 - The disruptive role of water to rethink this century

Restarting from water to rethink this century. This reasoning, as mentioned above, might seem too generic at a first glance. Nevertheless, analyzing such a wide concept from many points of view may be useful to better understand our modern and complex reality. The following section of the present work will focus on an introductive qualitative analysis of this element, according to its history, adding the best strategies to implement its use.

It goes without saying that water has always been regarded as the main element in life. The percentage of water present in the body of an adult man of average weight is between 60 and 65%, while the body of an adult woman of average weight is made up of about 50-55% of water. More specifically, according to Mitchell from the *Journal of Biological Chemistry*, as confirmed by further studies too, the blood is composed of over 90% of water, while the brain is made of 83% of water. The heart and lungs, instead, consists of 73% of water, while the skin stops at 64%. Muscles and kidneys do not go beyond 79%, against 31% of the bones. Furthermore, every day the individual must take in a certain amount of water to survive, consuming it through breathing, food digestion, and sweating. In general, an adult man needs about three liters of water, while an adult woman just over two (Mitchell et al., 1945). Hence, it is not surprising that water is considered a holy element for many religions as a symbol of purification and rebirth. There are numerous examples to mention: from Christian baptism to the similar Jewish “Tevilah”, from the water festival on the Buddhist New Year to the Hindus’ prayer for water called “Sandhyopasana”. Even many space researchers look for traces of water inside planets as a concrete clue of alien existence. This is the reason for the missions still in progress on Mars⁵, where the ESA - the European Space Agency - plays a strategic role.

This preliminary information clearly shows the correlation between man and water, a relationship that not surprisingly began at the dawn of prehistory, constantly increasing thereafter. The first notion that children learn in history classes about the earliest empires is that most of them were developed around water, especially rivers. Tigris and Euphrates in the Middle East, Nilo in Africa, and Indo in India are the classical examples. The advantages of living nearby water were numerous, mainly regarding agriculture and livestock but also for commercial and defensive purposes. This relation was further strengthened when man also started to sail on the sea, halving travel times in a time without roads. This explains the success of navigating peoples such as the Phoenicians and the

⁵ In 2022, “ExoMars” will land on the red planet, a project aiming at searching water on Mars.

Greeks, who colonized territories throughout the Mediterranean area. Then arrived the Romans, who developed a new bond with water dealing for the first time with its qualitative aspect. Test laboratories did not exist at the time of course, so parameters such as the origin of sources, transparency, taste, and water temperature were taken into consideration to evaluate the suitability of the supply. Thus, the Romans created aqueducts and spas, further developed until the early Middle Ages, when they were destroyed together with knowledge and healthy habits (Mantelli & Temporelli, 2010). During the high Middle Ages and the Renaissance, water regained part of its importance in a sort of pre-industrial environment ruled by trade. The first massive use of water was designed to spin mill wheels or bring water into cities. Inhabited centers were developed once again nearby water, as it happened in the Fertile Crescent. The more water there was, the richer the cities became because the presence of water allowed them to carry out a whole series of activities based on the economy of the time, including textile industry for instance⁶. With the industrial revolution, this aspect has become more and more significant because water was widely used for massive production but also to meet the needs of a constantly increasing population, as explained in the introduction. It is also worth mentioning the studies that focused on water, from the 17th century onwards, thanks to the work of geologists, engineers, chemists, doctors, who began to study its composition, gas content, and healing properties (Sorcinelli, 2016). Intensive water exploitation, per capita consumption due to exponential demographic growth, and water pollution, however, remain a concrete threat to the survival of mankind. This is the reason why we need to understand the real value of water, which differs from the perceived value of water that people have.

The price and value of water hardly ever coincide, mostly due to information asymmetries. In all likelihood, the lack of knowledge of water value leads us to consume more water or to waste it. An emblematic example for that is citizens' familiarity with the service allowing water to enter the house from the tap and exit through the pipes leading to the sewage system. There is still no awareness of what happens downstream and upstream. This is one of the reasons why there is an almost total discrepancy between the price of water and its value: the price of water, unknown to citizens, does not reflect the actual value that we assign to water but only the economic manifestation of its production cost, and sometimes not even that, hence just a small part of its value. The perceived abundance of this resource and the ignorance about the real extent of the perimeter of the integrated water service, combined with a discrepancy between price and value, make it difficult to establish

⁶ This aspect will be further analysed in the second part of the present work, with regard to the case study of Augsburg.

a water culture aiming to enhance the value of this resource and protect ecosystems. A low water value compared to its real value is likely to encourage a process of de-responsibility towards such an essential resource. According to Karen Kviberg, there are at least three components of water value to consider: economic value, ecological value, and social value. The discrepancy between price and value arises from the failure to recognize one or more of the components that contribute to the definition of the value of water, which are not incorporated in the price (Kviberg, 2008). In particular, the ecological and social values of water are underestimated. Recognizing the total value of water makes it possible to align the price of the asset with its real value, by quantifying the apparently hidden and management costs. Acknowledging the value of water is necessary to make decisions having a collective impact, with strong future repercussions on the economy, environment, and society. Such an approach would lead us to consider water no longer just as a good to be sold but as an integrated resource, strengthening forever its importance linked to its usage and scarcity worldwide (Berardi et al., 2020)⁷.

It follows that investing in water will soon become a priority worldwide, but it could also represent an important occasion for everyone to earn money sustainably. This is the reason why this resource is increasingly being referred to as the commodity of the future, the so-called “Blue Gold”, according to three main considerations. The first one, as anticipated earlier in the discussion, is based on its severe scarcity (almost 750 million people do not have access to drinking water today) and consume (by 2050, the consumption of water in urban and agricultural centers will triple for sure, also due to outdated systems, while the industrial consumption of water is likely to double). The second aspect is related to the refurbishment of the infrastructures in many large metropolises equipped with antiquated aqueducts, especially in Europe and America, together with new infrastructures in the incoming smart cities (Liberatore, 2019). The third and final reason for water being the “Blue Gold” refers to its use in high-tech sector, with the use of smart meters and digital detectors being only the beginning (Lecamp, 2019). Another issue is the desalination, requiring more studies and funding. For all these reasons, many investment funds were created, focusing exclusively on water. This analysis has now become the daily battle for authoritative and competent figures such as Torgny Holmgren, director of the Stockholm International Water Institute, recently interviewed on these topics by the Italian newspaper *Corriere della Sera* (Comelli, 2020). Fortunately, many organizations are starting to change their habits, as it will be better explained in the following sections of the present work.

⁷ This is one of the most developed arguments by the “Laboratorio REF Ricerche” of Milan.

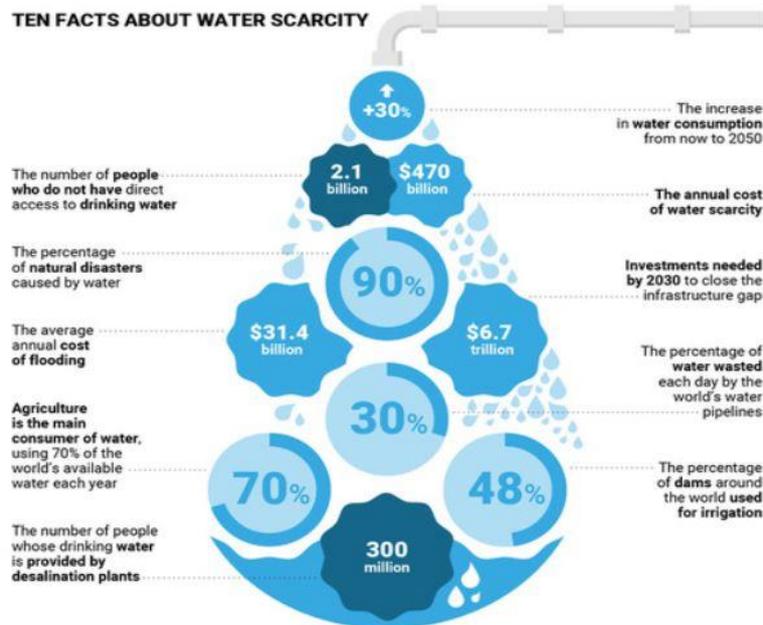


Figure 2 - Ten facts about water scarcity
 Source: Webuildvalue.com from UN Water Report 2018 - Year: 2019

There are, however, other examples of economic gains related to water that are not sustainable at all. Indeed, its commodification has become a major aspect for some private companies. The current water industry is dominated by a few corporations (oligopoly), led by France's Suez-Ondeo and Vivendi Universal, which alone control more than two-thirds of the global water resources market⁸. The third significant company is the German RWE that bought the UK's Thames Water in 2000. The dominance of these multinationals was possible thanks to the support received from their governments, the European Commission, and other institutions such as the World Bank, the IMF, and the WTO. Currently, only 5% of the world's water services are in the hands of individuals, yet even when public-private partnerships exist, it is the private partner who has the greatest bargaining power in this sector, with a consequent loss of authority and autonomy by government agencies that cannot effectively impose minimum standards of water availability and quality on companies. Other than by providing the service, the water market has found another way to profit from water scarcity: the bottling of mineral waters, the only method of water transportation that has really succeeded. It is one of the fastest growing industries in the world and one of the least regulated. Among the major players in this business, we must acknowledge Danone (the same group Ferrarelle belongs to) and Nestlé (including the San Pellegrino brand), respectively number one and two in the world water bottle competition.

⁸ The famous Cournot's model of oligopoly was inspired right by the analysis of competition in a mineral water duopoly in the mid-nineteenth century.

They are followed by Pepsi Cola and Coca-Cola. The consumption of bottled water is constantly increasing. At the beginning of the nineties, only 50 million people paid to buy bottled water, while today this number exceeds 300 million. Another issue is that most of the water is packaged in plastic bottles, producing large quantities of waste. It follows that private companies, by paying low prices for concessions, generate an enormous profit, yet disregarding social and environmental expenses (Depedri, n.d.).

In conclusion, not only the use of water should soon become sustainable but also its income. The so-called “ecosystem services” can summarize this hope. This term defines the ability of processes and natural components to provide goods and services that meet, directly or indirectly, the needs of all species, as suggested by the Millennium Ecosystem Assessment (2005). This international work program has provided a classification by dividing ecosystem functions into four categories:

- *Supporting*: these functions include the services necessary to the production of all ecosystem services and contribute to the conservation of biological-genetic diversity. This category differs from the other three because its impacts on people are often indirect or occur over a very long time, while changes in the others have relatively direct impacts.
- *Regulating*: these functions refer to other services that have direct and indirect benefits for humans, usually unrecognized until they are lost or degraded. Regulating functions deal with the availability and variety of food, water, raw materials, flora, and fauna.
- *Provisioning*: these functions include all the resource supply services. They focus particularly on climate, aquatic, erosive, atmospheric, and energetic regulation.
- *Cultural*: these functions deal with the maintenance of human health, providing opportunities for reflection, spiritual enrichment, cognitive development, recreational and aesthetic experiences, acting especially on culture, tourism, and landscapes.

As an illustration of this, wetlands (either natural or artificial) are a perfect example of “multi-service” ecosystems because they can perform different types of services. They provide habitat services as ecosystems of great importance for biodiversity, but also cultural services, as many wetlands are equipped for naturalistic tourism or painting, as well as regulation services thanks to phytoremediation potential. Normally, they are not used to supply raw materials and energy, even if the vegetal biomass produced in wetlands

could be exploited for that. For example, marsh straws can be used effectively as insulation in green buildings (Masi et al., 2017).

The following sections of the present work will highlight how these services and other similar projects can be applied concretely by using a bottom-up approach (second chapter), then a top-down approach (third chapter) to strengthen it, and finally an intermediate social development (fourth chapter), illustrating some concrete successful examples developed in recent years.

Chapter 2 - Future benefits of water from a bottom-up approach

As previously mentioned, the first step to elaborate a more sustainable development model – including a better use of water – may be based on a bottom-up approach. The aim is to develop a more concrete and personal interest among the population towards the arguments related to sustainability. This approach could greatly promote many areas of humanities such as art, history, geography, culture, and therefore have a considerable positive impact on civil and school education. Indeed, these fields of studies have recently been often overlooked or underestimated, in comparison to the more measurable scientific-technological ones, as observed by Gabriella De Marco in a recent article of great media impact on *Artribune* (De Marco, 2019). This contrast has persisted since the economic crisis in 2008, when university enrollments in humanities courses in various Western countries decreased to the advantage of enrollments in STEM degree courses. This also happened because the financial and political system, after such a disastrous crisis, preferred to invest in sectors with immediate and easily “calculable” returns, rather than in more abstract areas, yet of great social importance. A new focus on sustainability and technology (as it has already been partially done, for example in some Eastern countries such as China and Singapore) may be the driving force to relaunch these sectors (Corbellini, 2019). In this way, a better attitude could replace the current status quo, so often full of data, algorithms, schemes, and overconsumption but frequently poor in contents and creativity. In this sense, we will discuss some examples with a particular relationship with water.

2.1 - The historical bond between water and art until today

One of the sectors that can benefit more from this approach is the artistic world. The link between art, environment, and sustainability is, in fact, growing fast, as many historical and recent cases show. At the end of the 60s, the so-called “Land Art” movement made of this link its core, especially thanks to one exponent who recently passed away: Christo (Sicco, 1979). An example of his work is the famous installation “The Floating Piers”. It was a pedestrian path of about three kilometers on the waters of Lake Iseo, in Lombardy, in 2016. For sixteen days – from June 18th to July 3rd – that lake was completely reimaged. About 100,000 square meters of shimmering yellow-orange fabric were carried by a modular floating dock system of 220,000 high-density polyethylene cubes, undulated with the slight movement of the waves. Characteristics of this work were its temporariness and eco-sustainability. Indeed, the whole structure was meant to be recycled after use. The main

goal was to bring everyone closer to nature, inviting people to reflect not only on the visible finished object at a first glance, but mainly reflect upon the whole creative process behind that huge installation and its sensory activation role for the individual, regardless of age.



Figure 3 – The great dimensions of Christo’s installation “The Floating Piers”
Source: Artsy.net - Year: 2019

This was Christo’s main intention:

Like all our projects, *The Floating Piers* was absolutely free and open to the public. There were no tickets, no openings, no reservations, and no owners. *The Floating Piers* were an extension of the street and belonged to everyone... So those who experienced *The Floating Piers* felt like they were walking on water – or perhaps the back of a whale. The light and water transformed the bright yellow fabric to shades of red and gold throughout the sixteen days. (Celant & Blackburn, 2017).

There are also simpler examples of the relationship between art, nature, and sustainability, besides international artistic currents. Indeed, Ca’ Foscari University of Venice in collaboration with ArtVerona has participated in what is now the third edition of the Sustainable Art Prize⁹, presenting one or more artists working exclusively on sustainability issues. Especially through the means of artistic language, this initiative represented a concrete way to develop better attitudes among university students and the local community. This change in attitude should particularly focus on the global challenges illustrated by the 17 objectives of the 2030 Agenda for sustainable development. The “Ca’ Foscari Sostenibile” group has been organizing for years several programs dealing with these issues in an interdisciplinary way and maintaining a link to water in Venice.

Going even more into details, we can say that if there is a profound link between art and nature, art and water have an even stronger historical bond. Without the existence of water,

⁹ Link to the official website: <https://www.unive.it/pag/29219/>

art certainly would not have been the beauty we can admire today. Over the centuries, it has carried out a mission that overcomes the simple pleasure of the eye, ensuring formulated messages and shaped symbols depending on the various artistic currents. Numerous examples can be cited. From the rock graffiti depicting places related to water (such as “the Swimmers’ Cave” in Egypt) to the Middle East, Greek and Roman iconography of aquatic deities (like “the Venus of the Shell” in Pompeii). From the pre-Renaissance paintings related to baptism and purity (such as Giotto’s “Scrovegni Chapel” in Padua) to the most varied Renaissance works (like Botticelli’s “Venus” or Giorgione’s “Tempest”). From the extravagant Baroque paintings (such as Caravaggio’s “Narcissus”) to the dark romantic ones (like Turner’s “Shipwreck”). From fleeting impressionist paintings (such as Monet’s “Impression soleil levant” and Manet’s “On the beach”) to the haunted post-impressionist ones (like Van Gogh’s “Starry Night over the Rhone” or Cezanne’s “Lake Annecy”), concluding with the Land Art movement. Many other water-artistic examples could be illustrated as well (*Da Giotto a Van Gogh, l’acqua ispira i pittori*, 2013).

Returning to the present time, despite the absence of significant new currents linked to the use of water, many public and private organizations try to enhance this union between art and nature for a better future, especially from an environmental and cultural point of view. An organization that has recently had some success is the so-called “Acqua Foundation”¹⁰. Its main goal is to protect and conserve the most valuable resource that our earth can offer us: water. In this specific case, the biggest challenge is to work to improve the current water crisis and inform many communities on issues concerning the oceans, clean drinking water, and sustainable solutions for the future. In order to do this, art is intended as the most powerful tool to spread that message and influence public opinion strongly and effectively. In two years, this foundation was able to develop many different initiatives related to water. Among these, the realization of films such as “That which to come is just a promise” presented during the prestigious Cannes Film Festival in 2019; and musical events like the “Opening Concert at the BAM” – Biblioteca degli Alberi in Milan – by the “Filarmonica della Scala” in 2019. Other initiatives consisted in making short videos to propose a committed art on the less known environmental issues, such as the case project of “Nobilis Golden Moon” realized by Mariagrazia Pontorno in 2020 at the “Maritima01”¹¹ of Valencia. This last work focuses on the desacralization of the Mediterranean through the process of extinction of one of its symbols and sentinels, the Pinna Nobilis: it is a large mussel that exceeds a meter in height, at risk of extinction due to a local pandemic disease.

¹⁰ Link to the official website: <https://acquafoundation.com/>

¹¹ Link to the official website: <https://www.maritima01.com/>

These are only some examples that show the strong connection between water use and artistic expression. In the next section of this work, we will extend this connection embracing culture.

2.2 - The birth of a cultural ecology around the use of water

Linked to art, another field that has a strong and productive bond with water is certainly culture. Already in the 1950s, Julian Steward spoke of “cultural ecology”. By this, he meant that line of research in the ethno-anthropological sciences linking the socio-cultural aspects of man and the environment where he lives, in close relationship with other humanistic and scientific disciplines (Steward, 1990). The term “culture” itself comes from the Latin “colere” which means to cultivate; hence it is so strictly linked to the environment. This term refers to how a similar social perception is put into practice by a group that shares a system of knowledge, opinions, beliefs, customs, and behaviors, also linked to a specific place, recovering the concept of “habitus”¹² by Pierre Bourdieu (1979). From this definition, it is possible to derive an infinite plurality of sub-cultures. There is that of food, wine, work, landscape, territory, body, beauty, etc., just as there is one of water. This sub-category is enhanced by many organizations, especially by UNESCO.

UNESCO is the most involved institution working to build the scientific, cultural, and educational knowledge to help countries manage their water resources in a sustainable way today. This effort is ruled by the Intergovernmental Hydrological Program (IHP), leading the United Nations World Water Development Report, and by numerous Water Centers and Chairs around the world. In this sense, the UNESCO Chairs on Water are the clearest and most widespread examples of commitment worldwide. What follows is a list of the most important ones, divided into 8 main groups (UNESCO, 2021):

- Disasters related to water and hydrological changes with ten global Chairs;
- Groundwater in a changing environment with four global Chairs;
- Addressing the scarcity and quality of water with twenty global Chairs;
- Water and human settlements of the future with two global Chairs;
- Ecohydrology and engineering harmony for a new world with twelve global Chairs;
- Water education and key to water safety with three global Chairs;
- Water and gender role with five global Chairs;
- Water and culture with three global Chairs.

¹² Theory of Bourdieu: Habitus x Capital (cultural and/or economic) + Field (context) = Practice.

The role these Chairs play for the development of a more sustainable culture is indisputable, as is the contribution that museums can give for the same purpose. That is why there is a global network called “Global Network of Water Museums” (WAMU-NET) that has been created specifically for this goal. It was developed as a unique repository of different forms of links between water and its natural, cultural, tangible, and intangible heritage. It interprets artifacts, techniques, and traditional knowledge to promote the world’s outstanding variety of water-related heritage that has been passed down through civilizations and that still influences everyday life today. The idea is that “a larger network is an effective way to promote new water perceptions and more sustainable management models that can be developed for the emergence of «a new water culture»” (Water Museums Global Network, 2019).



*Figure 4 - Water Museums Global Network Trademark
Source: Watermuseums.net - Year: 1996*

Moreover, the WAMU-NET is an initiative endorsed by the Intergovernmental Council of the Intergovernmental Hydrological Programme linked directly to UNESCO (the so-called UNESCO-IHP), which works especially following the guidelines of the Sustainable Development Goals for educational and research purposes. 53 active members are involved in the network, 36 of which are museums, spread over all the world, in particular in Europe (26), Asia (6), America (3), and Africa (1). Specifically, Europe is the most developed area, involving many countries such as Austria, Belgium, Croatia, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Portugal, Romania, Spain and last but not least the United Kingdom. Furthermore, Italy can claim four well-developed organizations on its territory:

- the first one in Lombardy, the “Martesana Ecomuseo” near Milan;
- the second one in Emilia, the “Opificio delle Acque” in Bologna;
- the third one in Trentino, the “Museo delle Scienze” (MUSE) in Trento;

- the last one in Veneto, the “Water Museum of Venice” for the areas of Venice, Padua, and Rovigo linked to the river Po and other local rivers¹³.

In particular, one of the most supported initiatives by this network was the “1st Youth Contest 2020” called “The water we want” (TWWW). The aim was to explore multifaceted water worlds, especially from a youth perspective over a period of five months, from October 15th, 2019 to March 15th, 2020. Primary school students but also secondary school students were asked to present a work reflecting their personal vision about climate change or water. The output had to be a drawing, a photo or a video with a small description. This initiative represents another good starting point for a sustainable future water-oriented.

2.3 - Enjoying new water sustainability also during holidays

Linked to both art and culture, another aspect that can greatly benefit from this “water-friendly” situation is certainly tourism, especially after the European Charter for Sustainable Tourism was elaborated and adopted in Lanzarote in 1995 (UNWTO, 1995). The Charter explained in 18 points how tourism should evolve from that moment on. This document included topics such as the respect for all kinds of environment (mountain, hill, plain, sea, lake, river, etc.), the integration between nature and human culture, international and local cooperation, as well as the introduction of prices that consider the environmental impact. Along with this document, many organizations were founded to guarantee these goals. Among these, the Global Sustainable Tourism Council deserves to be mentioned. It aims to establish and manage global sustainable standards, known as the GSTC Criteria. These criteria are divided into two sets: Destination Criteria for public policymakers and destination managers, and Industry Criteria for hotels and tour operators. These are the guiding principles but also the future minimum requirements that any tourism business or destination should aspire to reach, to protect and sustain the world’s natural and cultural resources while ensuring at the same time power to tourism as a tool for heritage protection, national pride, and poverty alleviation (Global Sustainable Tourism Council, n.d.).

This is the reason why the future success of tourism is strictly linked to nature, but even more to water. There are three situations to consider, as already mentioned before, related to sea, rivers, and lakes. Indeed, the issue of water resources management represents a fundamental aspect that can determine the success as well as the attractiveness of a certain

¹³ We will further present the Water Museum of Venice in the second part of this research, talking about Venice.

area. The economic gain from these branches of tourism is considerable. Regarding the sea, it is possible to add two other case scenarios. One focuses on coastal tourism, which includes beach-related activities for which the proximity of the sea is an advantage, such as coastal sports, walks (useful for health thanks to the iodine), and observation of wildlife. The other case scenario focuses on maritime tourism, which refers instead to aquatic activities, such as swimming, sailing, diving, water activities, and cruises. A similar argument can be made also for tourism around lakes. These sectors have already been widely analyzed and exploited even if they are constantly evolving from an ecological point of view. The river sector, instead, has had a more recent development and therefore deserves to be explained in more detail.

River tourism, first developed in England, has gradually expanded into Europe. It gives life to a new idea of alternative “on board” holidays based on slow tourism. Here the protagonists are sustainability, slowness, experience, feeling, and authenticity. This type of holiday is suitable for all those who would like to be lulled by a river while a natural landscape or a place of art flows on the shore, spending the night sleeping right on the boat. The best-known places are undoubtedly the Burgundy and Loire in France, together with the Rhine in West-Germany and Holland, but the Veneto and Friuli regions in North-Italy are also starting to be well known. Here, an expert captain with a license at the helm of the boat will not be necessary, but everyone will be responsible for his own boat (Brega, 2019).

One of the most beautiful aspects in this kind of experience is that there are no borders¹⁴. Many countries work together, proposing shared structures and paths that reflect this trend. This is the case of the European Project “Ita-Slo Slow Tourism”¹⁵ developed by Italy and Slovenia in their respective border areas. In fact, the program area of interest extends over an area of 19,841 km² with a total population of about 3 million inhabitants. The entire area includes five Italian statistical regions – the so-called NUTS 3 – that is the provinces of Udine, Pordenone, Gorizia, and Trieste for the Friuli-Venezia Giulia region, and the province of Venice alone in the Veneto region, plus five statistical regions of Slovenia (Notranjsko-Primorska, Osrednjeslovenska, Gorenjska, Obalno-kraška, and Goriška). Concerning NUTS level 2 on the Italian side, the regions involved are Veneto and Friuli-Venezia Giulia, while on the Slovenian side we find Vzhodna Slovenija and Zahodna Slovenija. Many projects were developed between 2013 and 2020 confirming the current

¹⁴ This is one of the reasons why the European Union provides significant funds for this type of initiatives.

¹⁵ Link to the official website: <https://www.ita-slo.eu/>

relevance of responsible aquatic tourism. On February 22nd-23rd, 2017, the Supervisory Committee approved a plan implemented within the framework of the Territorial Integrated Investment of this cross-border area, including mostly the Municipalities of Gorizia, Nova Gorica, and Šempeter-Vrtojba. It was elaborated for the construction of the Isonzo-Soča river cross-border nature park, thanks to both investments in infrastructure (such as cycle paths and recreational areas), maintenance of local flora and fauna, and territorial marketing actions. At the end, the cost of the project was about 5 million euros (Ita-slo.eu Site, 2020).

Together with this European institutional development, other more spontaneous organizations joined forces, as in the case of the “Slow Tourism Network”¹⁶ which brings together 125 slow operators between Italy and Slovenia, from Emilia, Veneto, Friuli, Gorjska, and Gorenjska (so even a wider network compared to the previous one). Areas such as the Po Delta, the Venice Lagoon, the Comacchio valleys, the Venetian and Friulian rivers like Brenta, Piave, Sile, Adige, Tagliamento, and Isonzo up to the karst caves, the Bled lake, and the Piran salt pans are protected and promoted by public and private bodies, thanks to an approach capable of raising awareness among the population and tourists.

2.4 - Educating the incoming generations through water projects

Linked to art, culture, and tourism, the last aspect that can greatly benefit from this “water-friendly” situation is education. We have already mentioned something about the academic level while presenting UNESCO Chairs, but the focus of this paragraph will be more on the school level¹⁷. Regarding the Italian case, the National System for the Protection of the Environment (SNPA)¹⁸ promotes many education programs at the state level but also at the regional one, through the 21 Regional Agencies for Environmental Protection (ARPA) – Bolzano and Trento are considered separately in this – which allow for a broader and stronger development at the local level. The main topics covered by these agencies are especially related to water, air, soil, weather, environmental pollution, and energy, thanks to educational projects on sustainability, safety, and quality. For the sake of completeness, three different contexts will be analyzed by way of example, corresponding to the following three regions: Veneto, Lazio, and Sicily.

¹⁶ Link to the official website: https://www.slowtourism.net/contentsite/index.php?option=com_content&view=article&id=61

¹⁷ By “school level”, we intend kindergarten, primary and secondary school.

¹⁸ Link to the official website: <https://www.snpambiente.it/>

The first one carries out environmental education projects for citizens or particular categories of subjects such as students, teachers, and educators. In 2020, four projects were developed:

- Youth Forum for Sustainability 2020 – It is a participatory program for secondary school students elaborated within the Regional Strategy for Sustainable Development in collaboration with the Veneto region. This is also an opportunity for public organizations to strengthen their bond with the territory.
- Contest #arpaVideo 2020 – It deals with some video-maker students who sought to combine creativity and sustainability. The competition is reserved to audiovisual products made at the secondary school level on the 17 Goals of the 2030 Agenda.
- Contest QUALe idea 2020 – It offered awards to schools carrying out environmental courses on the UN 2030 Agenda among primary school children.
- “Raccontiamoci le favole” edition 2020 – These are workshops for kindergarten and primary school children to understand together the role of water, air, nature, waste, earth, and landscape to complete the great mosaic of the planet Earth.

What emerges most from these initiatives is that these are not only water projects, as they combine this element together with some others, just as ecosystem services want (ARPA Veneto, 2020).

Lazio, our second example, despite having the same characteristics and purposes of the previous case (Veneto), has developed different programs, divided into two categories:

- “I quaderni dell’ARPA Lazio” – They consist of short informative manuals designed to accompany primary and lower secondary school teachers in their work on sustainability issues. These books come with a comic starring Prof. ARPA, a fun read for children but also a tool to introduce sustainability issues, as in volume “A ... as Air” and volume “H ... as H₂O” to mention just two simple examples.
- The cards for environmental education – They are dedicated to teachers who want to undertake an education course on sustainability with their students, starting from the analysis of many environmental issues and elements such as water, waste, air, etc..

Most of these initiatives are still the result of the “Decade of Education for Sustainable Development” (DESS) for the period 2005-2014 by the General Assembly of the United Nations that entrusted UNESCO with coordinating and promoting activities for the decade which are still in action, especially at the school level (ARPA Lazio, 2015).

The third context we will present, by way of example, is Sicily. Sicily develops environmental education projects together with schools to increase responsible behavior among the new generations and offer opportunities for in-depth study and reflection, proposing for example the environmental education plan “ARPA meets the school”. Many classes participate to this plan, with the opportunity to be involved in training and environmental education activities specifically designed considering the school curriculum. All the meetings are held by staff of the Agency during school hours (ARPA Sicilia, n.d.). In particular, the “Mostra sulla Sostenibilità” (Sustainability Exhibition) is known for its aim of raising awareness among the community on the main issues relating to sustainable development (water, renewable energy, waste, climate change, protected areas, and food).

To conclude the first part of the present work, focusing on a bottom-up approach to promote sustainability, we will present a further example: the non-profit organization “Civiltà dell’Acqua”¹⁹. This is a very suitable example as this organization tries to promote all the initiatives we have illustrated so far for a more sustainable future. It works to increase a renewed sensitivity towards the environment and landscape by promoting the spread of new behaviors towards the water heritage.



*Figure 5 – The Civiltà dell’Acqua logo
Source: Civiltacqua.org - Year: 2020*

The objective is to contribute to the foundation of a new and more sustainable and international “Culture of Water”, by working especially on six actions that together can achieve this result:

- Organize cultural events, seminars, conferences, events, art exhibitions, and campaigns aimed at exploring many themes connected to the Civilization of Water;
- Collect and catalog any form of material and immaterial evidence of civilizations linked to water, safeguarding and enhancing their memory for the future generations;

¹⁹ Link to the official website: <http://www.civiltacqua.org/>

- Promote competitions, publications, projects on the issues of civilization and knowledge of water; report experiences, emblematic cases, and noteworthy works;
- Contribute to bringing water back into the compositional alphabet of cities (squares, open spaces, public buildings, schools) and homes (parks and private gardens);
- Encourage studies and organize reflections on “border issues”, at the intersection of humanistic, scientific, technological, environmental, and landscape disciplines;
- Provide scientific and regulatory information useful to citizens and communities, to administrators and legislators; collect and process scientific, cultural, and planning information and documentation to deepen and spread a new Water Culture.

After focusing on a bottom-up approach to promote sustainability, the following chapter of this research will focus on a complementary vision based on top-down and more complex decisions. It will concern areas such as difficult international politics, sustainable finance, circular economy, and disruptive technology, illustrating what has been explained so far with other even more suitable examples.

Chapter 3 - Future benefits of water from a top-down approach

The second step to elaborate a more sustainable development model – also including a better use of water – may be based on a top-down approach. Once a certain awareness and collective interest in these issues are spread among the population, a further and more significant effort is required. This endeavor should come firstly from international institutions and secondly from economics and finance, bringing a transparent system together with adequate monetary resources for the desired sustainable transaction. Furthermore, a proper use of technology could be useful to control the data quality results and to spread them globally quickly, especially for the poorest countries. This was the hope of the Italian President Mattarella a few months before the Covid-19 global pandemic started, and it is now more urgent to restart (*Mattarella: sviluppo sostenibile unica via*, 2019). In the following paragraphs, we will move from a general perspective to a more specific focus on water, which can be considered the leitmotif of this master's thesis.

3.1 – The geopolitics of water grabbing against peace

One of the aspects that could certainly benefit from this renewed “water-friendly” situation is international politics. Indeed, Ismail Serageldin, vice president of the World Bank, stated prophetically in 1995 that “the wars of this century have been on oil, and the wars of the next century will be on the water... unless we change the way we manage water” (Barnaby, 2009). This statement should be a warning for international politics, already heavily involved in a sort of geopolitical “cold war” for water. The strongest cases of tension are recorded in international water basins and concern watercourses that are often of considerable length and that cross several countries. In these contexts, the geographic position of the basin plays a relevant role, as the upstream countries can regulate the quantity and quality of the flow of water that reaches the downstream countries. This is the case of the Colorado River that originates in the United States and flows into Mexican territory. Here the river is transformed into a stream of mud due to the Hoover Dam on US soil. This caused many tensions, together with the political case of the Rio Grande which also represents the physical border between the two countries. Another well-known case is the Danube River that originates in Germany and flows into Romanian territory after crossing six European countries. Despite some existing contrasts like the one due to the

Gabčíkovo-Nagymaros dam between Slovakia and Hungary²⁰, an environmental protection program was launched in 2009 (Environmental Program for the Danube River Basin). Another more problematic case is the Nile River, divided into the White and Blue Nile, after flowing through eight African countries directly before it enters Egyptian territory. Recently, the already unstable “pro-Egyptian” situation has changed without seeking new more equitable balances (a similar example is the case of the Millenium dam in Ethiopia on the Blue Nile against Sudan and Egypt). This situation throws further instability and poverty into the already burdensome Horn of Africa. These are only a few examples, but unfortunately the worldwide list is much longer today²¹ (Ferragini, 2015).

These difficult political situations are also strictly linked to the overwhelming problem of what is called “water grabbing”. According to the Water Grabbing Observatory, this term refers to a situation in which powerful actors, like States as in the previous examples but also other entities as multinationals, can take control or divert water resources to their own advantage, stealing them from local communities or entire nations. Water is then transformed into a private good controlled by those in power and for which anyone is required to pay them a price directly. Therefore, water grabbing represents one of the most widespread processes of violation of human and social rights, of appropriation and depletion of water and natural resources (Water Grabbing Observatory, n.d.). Most of these topics have been recently covered in a book, dealing with these issues and proposing some solutions (Bompan & Iannelli, 2018). Indeed, the authors’ approach to the theme of water is multidisciplinary, as this master’s thesis tries to be too. Through the various chapters, the authors illustrate the many dimensions in which it is possible to observe the consequences of historical mismanagement of water. Thus, in the conclusions of the book, a new hoped “circular economy” is proposed, no longer a linear economy (a topic that will be shortly discussed later in this dissertation), by looking at today just as a starting point for rebirth and not as a rigid point of irreversible arrival.

This is the reason why talking about better water management would contribute to solve many international political problems. At the moment, the situation is delicate, but some institutions are already positively involved to promote better changes. For example, there are international organizations such as the United Nations Development Programme

²⁰ The book “The Price of Thirst” by Karen Piper (2014) perfectly illustrates this difficult relationship into details.

²¹ Just think of the Mekong River in China, Tibet, Myanmar, Laos, Thailand, Cambodia, and Vietnam. Or to the Ganga River in India, Bangladesh, and Nepal. Or to the Tigris and Euphrates Rivers in Turkey, Iraq, and Syria. Or even to the disappearance of the Aral Sea in Kazakhstan and Uzbekistan.

(UNDP) or the United Nations Environment Programme (UNEP). There are also recent political plans, such as the European Green Deal which will mobilize at least one trillion euros to make Europe the first zero-emission continent by 2050. For Goal 6 on water, the Green Deal does not foresee a targeted action but envisages transversality in many strategies considering industry and circular economy, zero pollution objective, a contrast to climate changes, and a new biodiversity strategy (Di Marco, 2020). Nonetheless, too many public and private actors are still waiting to see the evolution of events, and at the same time many others continue undeterred in their destabilizing decisions (as such, absolutely unsustainable).

That being said, without forgetting the active role played by UNESCO in political terms thanks to the International Hydrological Program (IHP), there is also another organization that focuses on water only, to promote such a desired improvement. It is the World Water Council (WWC). It is defined as “an international multistakeholder platform organization whose mission is to mobilize action on critical water issues at all levels, including the highest decision-making level, by engaging people in debate and challenging conventional thinking. The Council focuses on the political dimensions of water security, adaptation, and sustainability” (World Water Council, 2020) conducting active hydro-politics, organizing world forums and elaborating reports on water, and addressing related emerging challenges. The water initiatives that this organization carries out are therefore fundamental to finance and impact many aspects such as security, climate change, politics, and better governance of the cities. Great importance is also given to the triennial world water forums, the last of which was held in Brasilia (2018), while the next will be in Dakar (2021), Covid-19 permitting. In the next few years, the main challenges faced by politics will be almost the same as finance and economy, focusing on promoting a fast, sustainable and holistic post-pandemic restart. That is why it is essential to invest money in the field of sustainability in the future.

3.2 - The importance of financial funds on water

Linked to politics, another element that can benefit from this “water-friendly” situation is certainly finance. A consolidated relationship now exists between this sector and sustainability. ASVIS even dedicated many detailed reports and an entire festival in September 2020 to the theme “Public finance for economic recovery: the importance of the 2030 Agenda for sustainable development”, without forgetting the refresher course for

companies called “Company 2030 - The opportunities for sustainable development” (Manzo, 2020). Since then, it can be said that the term finance encompasses two subsectors that concern the public and private spheres. The latter can be further divided in turn into corporate and private. The following considerations will concern all the categories listed above and will be analyzed starting from the most specific case, up to the most general one. Regarding private finance, the primary purpose of any financial advisor is to help clients make profit-oriented investment decisions by creating financial plans tailored to their individual needs. From this premise, it is already clear how important it is for a financial advisor to be updated on new trends. Particularly, in recent years the interest has focused on the so-called “megatrends”. These are powerful global trends that affect the economy in a so pervasive, persistent, and deep way that the investors cannot ignore them if they want to achieve consistent returns over the long term. The effort to analyze the structural forces that shape this world, dominated by uncertainty and sudden change, represents a concrete help for individuals, companies, and governance sectors. There are many strategies megatrend-based that regard health, renewable energy, digital world, environmental protection, biotech, nutrition, premium brands, robotics, safety, wood, and finally water, the focus of our dissertation. Indeed, investments in the latter case help those companies which operate in the water sector globally, from those that improve existing infrastructures by reducing waste and costs to those that develop new products and services to solve the scarcity and increase production thanks to technological innovations (Pictet Asset Management, 2016b)²². Many organizations are dealing with this trend. We will present two cases related to funds and one related to the ETF index²³.

The first example can be found by looking at Pictet Asset Management. Since the beginning of this millennium, this group proposed a stock called Pictet-Water-R EUR (Isin - LU0104885248). It is managed by five specialized managers with a broad experience in that field, managing a total asset amounting to 3.1 billion euros at the end of 2017. It is characterized by a high annual return of around 6% and a high volatility of 14% due to investments in emerging countries and so with currencies that can show high fluctuations, as illustrated in the following diagram (Pictet Asset Management, 2016).

²² The Pictet Group is a banking group founded in Geneva in 1805, specializing in wealth management and asset management, that has become a benchmark in this sector in Europe.

²³ The difference between fund and ETF is that the first one is actively managed by a financial advisor, while the second one, being an index, does not require an advisor. This could explain the recent success for experienced investors of ETFs as they have lower management costs, but also some big failures for those less competent who would need an advisor instead.

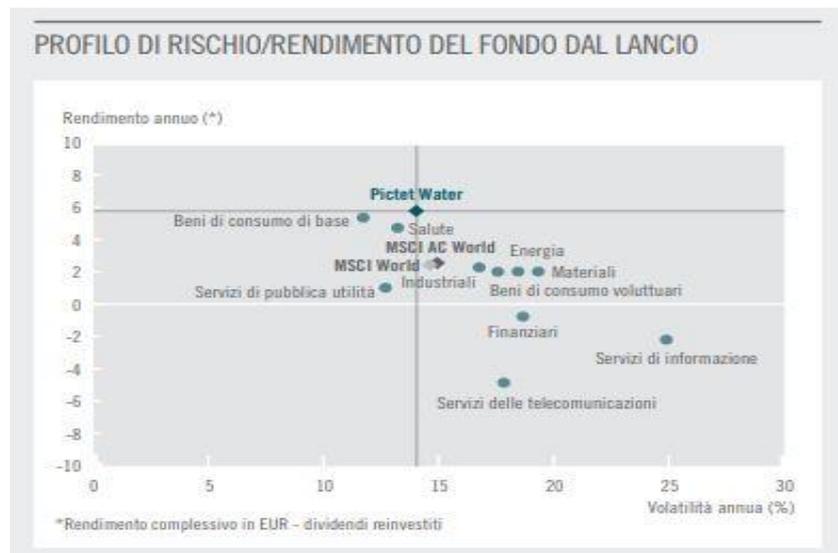


Figure 6 - Pictet Water Management Brochure (diagram)
Source: Pictet Asset Management - Year: 2016

The second example we wish to present comes from BNP Paribas²⁴. This banking group proposed the fund BNP Paribas Aqua Classic Cap Eur (Isin - FR0010668145) in 2008 as part of its Corporate Social Responsibility (CSR) strategy and its commitment to the UN's Sustainable Development Goals. The portfolio is composed of the best 50 international shares. In 2018, the Group managed €3.2 billion in assets in this fund category, very close to the Pictet results, divided into €1.942 billion from the BNPP Aqua fund and €1.287 billion from the Parvest Aqua fund. It is characterized by a high annual return of around 7,5% and a high volatility of 17,5% (BNP Paribas, 2019). Besides the two examples presented, other cases exist, as the Sustainable Water & Waste Fund E-ACC-Euro (Isin - LU1915587072) but what has been illustrated so far seems to be enough.

The third example, instead, is different. Taking an index as an example is useful to better explore the differences between funds and ETFs. The Invesco Water Resources ETF (NASDAQ: PHO) offers exposure to companies in the water sector. Some of these offer products to preserve and purify the water. Others get income from the drinking water and wastewater industries. It is quite diversified in terms of sectors with machinery accounted for 30.34%, water services for 20.10%, health equipment and supplies for 7.83%, construction products for 7.79%, and the chemical industry for 7.65%. There are other water-related ETFs that may be appropriate for a range of long-term portfolios as the Ecofin Global Water ESG Fund, the First Trust Water ETF, or the Invesco S&P Global Water Index ETF, as highlighted by many trading sites (*Perché un ETF legato all'acqua*

²⁴ BNP Paribas is a credit group operating in financial services and one of the six most important banks in the world according to Standard & Poor's rating firm. The Group is present in Europe in four domestic markets through the retail bank: Belgium, France, Italy, and Luxembourg.

potrebbe spingere i portafogli buy and hold, 2020). Besides, there must be a reason if Michael Burry, who predicted the 2007 crisis, has been investing since 2010 in water only (Lewis, 2010).

All the above aspects on a private level can be applied to corporate and public investments in water. The benefits are numerous, that is why such investments are strongly recommended. According to this point of view, the “Public Finance for Wash” organization deserves to be mentioned. As explained on its official website²⁵, it embodies a research initiative around domestic public finance for water and sanitation, based on the idea that universal water is fundamentally dependent on well-functioning domestic taxation systems. Moreover, the key actors (governments, donors, NGOs) need to ensure the aid funds in the best manner, promoting the development of equitable domestic public finance systems. Starting from this idea, it is possible to enlarge the vision to the current economic system.

3.3 - The role of water for the circular economy

Linked to politics and finance, another element that can benefit from this “water-friendly” situation is certainly the economy. As already anticipated in the introduction, erroneous conceptions of economic progress based on quantitative aspects must be abandoned. A sustainable post-pandemic restart can be achieved instead, thanks to qualitative models and approaches. In this sense, the circular economy (strictly linked to the blue economy) can answer this request. The term “circular economy” underlines the desire for sustainable growth, in the current context of increasing pressure on which production and consumption regulate global environmental resources. Until today, the economy has worked with a linear “production-consumption-disposal” model, where every product is relentlessly designed to reach the end of life. The transition to a circular economy is shifting the focus to reuse, fixing, renewing, and recycling existing materials and products. Thus, every single product can be continuously reused within the production cycle, generating additional value (European Parliament, 2021). What used to be considered waste can be transformed into a new resource, following the main idea that nothing is created, nothing is destroyed, and everything is transformed. This mantra has a long history, starting from a philosophical base with Anassagara, Heraclitus, and Empedocles in ancient Greece, and coming to a more scientific vision thanks to the studies of Antoine-Laurent de Lavoisier, up to Einstein’s most recent studies.

²⁵ Link to the official website: <https://www.publicfinanceforwash.org/about>

That said, the focus of the next paragraphs will be on the use of water linked to the circular economy. Indeed, at the European level, the project “NextGenWater”²⁶ deserves to be mentioned. It aims to boost sustainability and bring new market dynamics throughout the water cycle. In this way, the social and governance challenges will benefit from long-term support by circular economy solutions (NextGen, n.d.b.). Moreover, within this project, a detailed paper focusing exclusively on the relation between water and circular economy has been written, divided into four main parts. It illustrates the starting point, the establishment of a common understanding, the engagement of many institutional and private stakeholders, and the concrete implementation on cities and territories (Arup et al., 2018). From this premise, 10 large-scale deployments occurred immediately in eight European states, precisely in Altenrhein (CH), Athens (GR), Braunschweig (DE), Costa Brava Region (ES), Filton Airfield (UK), Gotland (SE), La Trappe (NL), Spernal (UK), Timișoara (RO) and Westland Region (NL). The most interesting one is related to Gotland, an isolated Swedish island, because it deals with water only and not other elements such as energy or waste. This island experienced a water crisis, negatively affecting tourism and small-scale industries. Water scarcity hinders economic development due to strict regulations for building new houses and starting new businesses that can consume water. A national fund in the water sector is currently under development. It consists of an integrated system based on small-scale methods as rainwater harvesting from drainage ditches, automatic hatches in large ditches, artificial surface water dams, and climate neutral desalination based on solar energy (NextGen, n.d.a).

Another less funded but still very ambitious project is certainly that of “Hydrousa”²⁷. This is a new circular business model, which will be more suitable for the sea and the coasts of the Mediterranean (in particular it is already present in Greece) and subsequently to other scarce water regions in Europe and the world. It aims to provide some innovative solutions for decentralized water scarcity areas in terms of water, treatment, and wastewater management, adopting innovative, nature-based, and nature-inspired water management solutions for different types of water characterized by low energy impact.

What these organizations and many other similar ones intend to follow are the guidelines of the *Addis Ababa Action Agenda* (UN, 2015). This plan provides a new global framework for financing sustainable development by aligning financing flows and policies with economic, social, and environmental issues. It includes a set of policy actions, with over

²⁶ This initiative is financed directly by the European Commission through the Next Generation EU which will invest 390 billion euros in grants and 360 billion euros in loans to member states.

²⁷ Link to the official website: <https://www.hydrousa.org/>

one hundred concrete measures that draw upon all sources of finance, technology, innovation, trade, debt, and data, to support the achievement of the Sustainable Development Goals. Indeed, there are seven major development topics regarding:

- Domestic public resources;
- Domestic and international private business and finance;
- International development and cooperation;
- International trade as an engine for development;
- Debt and debt sustainability;
- Addressing systemic issues;
- Science, technology, innovation, and capacity-building.

All these intentions can be achieved only if there is also an adequate use of technology to improve the current situation even more and, why not, social media, capable of influencing our tastes so much. This last aspect will be deepened in the following section.

3.4 - Technology and social networks for water systems

Linked to politics, finance, and economy, one further aspect that can greatly benefit from this “water-friendly” situation is technology. This sector, too, was no stranger to the wave of sustainability. Despite the deep bond that increasingly characterizes their relationship, however, sustainability and innovation have often been considered antagonistic forces. Specifically, until a few years ago, the implementation of technological and industrial innovations was considered as one of the main causes of consumption and pollution of natural resources. Today, instead, innovation and sustainability in their broadest sense are so virtuously connected that one is fueled by the other. In fact, as reiterated also in the context of the Sustainable Business Revolution 2030 presented by Capgemini²⁸ during the World Climate Summit 2019, it is possible to make a difference only by integrating technology into the sustainability strategy and objectives. Therefore, businesses and national leaders have the responsibility to identify how technology can enable new, better consumption and sales models, as well as products and services that have a positive impact on people, planet, and profit (Ippoliti & Giuliani, 2020). This revolution obviously passes also through the academic field. For example, the Polytechnic of Turin inaugurated the “Technology Biennial”²⁹ in November 2020, presenting one of the main public exhibitions

²⁸ Capgemini is an active IT company for the consulting and provision of professional services.

²⁹ Link to the official website: <https://www.biennaletecnologia.it/>

dedicated to the decisive role that technology has taken on in all areas of life, from the environment to health, from information to finance and politics. Distinguished guests of the Biennale were Enrico Giovannini³⁰ and Gunter Pauli³¹. From this new perspective, water can be one of the protagonists of the relationship between technology and sustainability, as shown by the following examples.

In this scenario, the International Water Association is a global reference institution that tries to implement most of the sustainable ideas previously suggested about water, focusing specifically on technological innovation to achieve all the objectives. It could be intended as a source for leading-edge water knowledge (IWA Network, 2018) that aims to:

- Engage and inform the global water community on the implications of future trends;
- Promote innovation to address global change and develop solutions and strategies;
- Promote new business and finance models to address the SDG-6 goal on water;
- Encourage a systemic approach to the application of the circular economy;
- Be an authoritative source and global reference for the emergence, influence, and impact of the growing digital water economy that could reshape the water sector.

Thanks to these efforts, even more private, public, and non-profit digital-oriented organizations have been recently founded around water, leading to the birth of the so-called “hydroinformatics”. A good example for this is the “Hydroinformatics Institute” of Singapore city³². There are three main research areas in this institute. The first one is related to consulting, which means helping clients to understand what is at stake and how to manage it, especially on inland water systems, coastal and oceanographic water systems, and weather. There are examples of this kind in Oman, Singapore, and Sri Lanka. The second research area is linked to operational water management, which means feeding real-time data from direct and indirect monitoring of various parameters into computer models. Clients are water agencies in Singapore, Vietnam, the Middle East, and Brunei. The third research area concerns digital services, which means applying the information gathered by advanced analytics to obtain a competitive advantage, also using sophisticated 3D models.

³⁰ Chief Statistician of the OECD (2001-2009), President of Istat (2009-2013) and Minister of Labor and Social Policies of the Letta government. Co-founder and spokesperson of the ASviS.

³¹ Founder of the so-called “Blue Economy”.

³² This institute has applied advanced processing (such as big data analytics, machine learning and advanced modelling) to big water data, in a place rich in rainfall due to the climate of this Asian island. For further information: <http://www.h2i.sg/>

Another similar organization working on hydroinformatics is “Imagine H2O”³³ that presented at the last event of the “Water Online Week” as many as 14 innovative start-ups, suggesting a range of solutions that could reinvent a future resilient to water. These are the solutions presented:

- Arable (USA): sensor and analytics platform that can provide actionable real-time insights with predictive capabilities especially for food and industrial systems;
- Cloud to Street (USA): flood risk detection that uses global satellites, machine learning, or community intelligence, targeted for emerging market households;
- Drinkwell (India): ATMs for communities affected by arsenic and fluoride through patented filtration technology, IOT-enabled operations, and many payment cards;
- Ecosoftt (Singapore): low-cost solutions for wastewater and its reuse for the communities not connected to water in the surrounding of Singapore city;
- Electrolytic Technologies (USA): on-site chlorine generation that eliminate costs and risks from transporting chemicals to water and wastewater treatment plants;
- Fluid Robotics (India): in-pipe³⁴ robotic mapping and assessment tools to detect leaks in the distribution systems to prevent the runoff of pollution into urban areas;
- Ignitia (Sweden/Ghana): weather forecasting platform that sends highly accurate hyper-local forecasts to smallholder farmers via SMSs, social networks, or e-mails;
- Oneka (Canada): desalination for the autocratic production of drinking water for small island communities to promote a basic subsistence of this resource;
- SatSure (India): irrigation monitoring, cooperative and decision-making platform based on satellite remote sensing, useful for governments and communities;
- SmarterHomes (India): intelligent metering and automated loss prevention system for the high-rise apartment buildings in urban India like Mumbai, Delhi, or Calcutta;
- SmartTerra (India): operational intelligence for water and wastewater services to reduce losses, assess the health of the network, and improve private revenues;
- Vassar Labs (India): sophisticated water forecasting and management platform for state agencies using satellite imagery, in situ sensors, and predictive analytics;
- Veracet (USA): kind of DNA fingerprinting technology and analysis platform to identify the main source of contamination in water, especially for industries;

³³ Imagine H2O is a non-profit organization that empowers people to develop and deploy innovation to solve water challenges globally, by evaluating and financing projects from start-ups (123 up to now).

³⁴ The data pipeline is a technology used in the hardware architecture of computer microprocessors to increase throughput, which is the number of instructions executed in a given amount of time.

- Wonderkid (Kenya): mobile water management platform for hydric services to improve the quality of their customer support and billing services in arid areas.

Such projects are increasingly popular, including in the banking sector (Viola et al., 2020). This is due to the fact that they can be of great help to people, territories, and cities, as it will be further illustrated later. Before that, however, it is also interesting to show a remarkable interest in water in social media. The section of the United Nations for water has even dedicated some writings on this. We will just mention the article *Water Ripples Social Media* where it is explained that since 2015 at least three posts per second have been published on social media such as Instagram and Facebook during World Water Day. All of this has turned into a media wave reaching at least 1.3 billion people a year, increasing over time (UN-Water, 2015). Up to now, the posts with the hashtag *#worldwaterday* are almost 200,000 on Instagram only. This is relevant because social media are increasingly shaping our tastes and for once they could also be socially useful for society. This aspect will be further analysed in the fourth chapter.



Figure 7 - Water Ripples Social Media
Source: UN-Water - Year: 2015

Chapter 4 - Future benefits of water for society

After developing a bottom-up and top-down approach, it is now necessary to put these assumptions really into practice. The goal is to create a better, more sustainable and resilient society that increasingly seeks out green and blue spaces and aims at new prospects especially in the primary, secondary, and tertiary sectors. This is one of the basic objectives of the so-called “smart cities”. According to the European Commission, these are places where traditional networks and services are made more efficient thanks to modern technologies for the benefit of people and businesses. Indeed, the use of information and communication technologies (ICT) is fundamental for better resource use and fewer emissions. In this way, it is possible to develop smarter urban transport networks, upgraded water supply, and waste disposal facilities together with more efficient ways to light and heat buildings. It also means a more interactive and responsive city administration, safer and greener public spaces, meeting the needs of an aging and increasing population (European Commission, n.d.).

4.1 - The beauty of water in cities

One of the most important aspects of water that has not yet been discussed in this thesis concerns its beauty and social role in the urban context. This is the case of the so-called “blue spaces”, to which the “green spaces” are directly added and that can be intended as urban “blue-green infrastructure” (BGI). The aim is to develop a network of natural elements located in built-up areas that are part of the city landscape. These characteristics are mainly based on vegetation (green), water (blue), or both. Water squares, cloudburst boulevards, rain gardens, rivers, lakes, marshes, ponds, grassy areas, trees, parks, green roofs, and walls are all examples of this type of architecture (Brown & Mijic, 2019). The benefits of the blue-green infrastructure are manifold. Firstly, it reduces air, noise and even light pollution significantly, as well as mitigating the climate in the winter and summer. Secondly, a large-scale use of blue-green infrastructure can reduce climate change and significantly promote biodiversity. Lastly, it could also fight stress and overweight, offering a wider range of physical and mental benefits for people, without forgetting an increase in social relationships (Re, 2016). Therefore, green and blue spaces will be the best new ally of the urban population for its happiness, wealth, and life expectancy. A choice of this type can also affect the economic value of the area, increasing its notoriety and liveability, creating the controversial effect of “gentrification”.

It is interesting to further explore this type of infrastructures by showing at least one of the less known projects that will hopefully be soon developed on a large scale: the water square. It represents an innovative way of managing and collecting rainwater in cities, which appears at first glance as simple public spaces but instead it is capable of being transformed into something more. Local administrations around the world are now increasingly struggling against climate emergencies and the related difficulties. This shows how it is of primary importance, in an urban setting, to remove rainwater safely and sustainably as well as to store and reuse it when it is most needed, especially for domestic, agricultural, and industrial reasons. The idea of water squares was conceived by the Dutch multidisciplinary group “De Urbanisten” and by the Studio “Marco Vermeulen” for the 2005 Rotterdam Architecture Biennale³⁵. This novelty is based on a simple concept: to create dynamic and attractive public spaces whose beauty is visible to citizens (who personally pay these interventions through taxes), to increase their water sensitivity. Moreover, water squares can also be transformed into rain collection and water storage basins if necessary.



Figure 8 - Water squares: squares as storage areas for rainwater
 Source: Fotofoltaicosulweb Site - Year: 2020

These places are presented as areas for play and relaxation 90% of the time when they are “dry” and usable like any other traditional public space, while in the remaining 10% of the time, and based on the intensity of rains, they can be more or less “flooded”. The square, regardless of the level of flooding, will still be usable and some spaces will always be

³⁵ The Netherlands has of course a special connection with water. Water is its best friend and its worst enemy. For further information: <https://www.holland.com/it/turismo/storie-dolanda/olanda-terra-dacqua/acqua>

available to citizens. Adults will be able to enjoy new and ever-changing urban scenarios, and children will experience new forms of play. Statistically, the stagnation of water at its maximum levels does not exceed 32 hours for hygienic reasons. This new type of public space has found its first small-scale application in the “Bellamyplein water square” in Rotterdam in 2012, with a “floodable” area of about 300 square meters and a water collection capacity of 750 cubic meters. Its medium-large scale application is represented instead by the “Bentemplein water square”, with the capacity to store approximately 1,700 cubic meters of water (Rossi, n.d.).

While the case of water squares represents a novelty especially intended to manage excess water, we will now introduce an opposite scenario, namely when water is scarce and must be reused as much as possible. About this, the “Pact for Water” elaborated in 2018 by the Italian Environment Fund to create a national strategy for saving, recovering, and recycling water deserves to be mentioned (FAI, 2018). This is a really important issue, especially for green spaces. In this respect, rain gardens³⁶ are certainly a good example within urban contexts. Sustainable practices of this category, however, can also be found in less urban systems, such as those of historical gardens. Here the use of water is even more essential for the plants in the first place but also for the meanings and aesthetics of the place itself, which would otherwise suffer without this resource. Considering the Italian national context, the “Grandi Giardini Italiani” network is relevant for its role in the development of sustainable green and blue spaces. It includes the most important and beautiful Italian historical gardens that influence each other as if they were “an industry of creativity [...] where thousands of people are engaged throughout the year in enhancing Italian gardens and providing added value to those who visit them” (Wade, n.d.). In particular, one of the gardens of this network that has an indissoluble bond with water is certainly the Garden of Valsanzibio³⁷ in the Euganean Hills. Here, in the nineties, a large investment was made to make the system of fountains, water jokes, and fishponds electric, so that over 70% of the water could be reused. In this way, the seven original water sources of the late 1600s were largely restored, managing to circulate just from there up to 150 litres of water per minute in all 33 original outlet points. Of course, this is an advantage from an environmental point of view, but it also led to an increase in costs which the garden has decided to take on to maintain the beauty of the place and for the pleasure of its public.

³⁶ They are slight depressions in the soil covered with vegetation for an aesthetic purpose but also to reduce pollution and control the rainwater coming from roofs, roadways, and other areas.

³⁷ I had the opportunity to work as an intern in this place, therefore I know it particularly well. Link to the official website: <https://www.valsanziobiogiardino.com/it/>

4.2 - Agriculture needs another use of water

In addition to its aesthetic value, water will increasingly play a leading role in many areas, continuously involving the primary sector of agriculture and farming, the secondary sector of industry and energy, and the tertiary sector of services and communication. We will now explore the first case related to agriculture, showing firstly some data about its importance and secondly some innovations concerning this sector.

According to the Barilla Center for Food & Nutrition (BCFN) Foundation, about 70% of freshwater withdrawn from surface sources or groundwater is used in the agricultural sector and therefore is the basis of food production, while beyond 90% of our water footprint is linked to the consumption of food. Only the remaining 30% is destined to industrial and domestic use. This will also have a huge impact on other scenarios such as migration, given that by 2030 it is expected that the scarcity of water will cause the displacement of 24 to 700 million people (BCFN Press Office, 2019).

Although the percentage of freshwater consumption available for agriculture is already exorbitant, current harvests are not enough to feed the growing population of our planet. Without changes, it will be difficult to achieve a 70% increase in agricultural production by 2050, a necessary share considering the rate of population growth. Multiple solutions can be found, which can also be applied together. One of these is to grow those plants that consume less water or to develop techniques that reduce average water consumption. As for this last case, a group of scientists from an international project called “Realizing Increased Photosynthetic Efficiency” (RIPE) developed a technique aimed at making plants retain more water, reducing their consumption by 25%, without compromising the production. All this simply by altering the expression of a single gene that is shared by all plants, to close the stomata and reduce photosynthesis, playing on four main factors: humidity, levels of carbon dioxide inside the plant, quality, and quantity of light. This study was published in *Nature Communications* in 2018 (De Luca, 2018).

Another more radical solution deals instead with the so-called “vertical farming”³⁸. This idea was conceived in 1999 by a professor at Columbia University called Dickson Despommier. It took however another ten years to see the first working pilot model in the

³⁸ Link to the official website: <http://www.verticalfarm.com/>

UK. In 2010, the founder himself decided to write a book³⁹ on the subject, summarising all the ideas about buildings full of fruit and vegetables that will provide local food sources for entire cities (Despommier et al., 2010). The creation of these vertical farms will soon allow any society to:

- Grow healthy food 24 hours a day, 365 days a year, all over the world;
- Protect any crops from unpredictable weather conditions and shipping;
- Reuse the water collected from the indoor environment and reduce its general use;
- Provide zero-kilometre work for residents and recover abandoned buildings;
- Eliminate the use of pesticides or fertilizers and reduce fossil fuels dependence;
- Stop agricultural runoff (from indirect pollution) and defend biodiversity;
- Develop sustainable realities even in poor countries or with little arable land.

This idea is obviously brilliant in itself, however its practical execution remains a problem as today vertical farms are simply too expensive to build and manage. Many companies have tried to solve this complicated equation. One of these, which is obtaining excellent results, is the “Zero Srl” of Pordenone. Here an almost maniacal control of every single hardware and software component is required to ensure that each element works perfectly with the others. Hence, convenient and simple vertical farms are born, managed mainly by reliable machines (ROOT⁴⁰) without requiring many expensive workers or engineers. Productivity per square meter must be high as well as energy efficiency. The plans are conceived through customizable modules, connected as a network, which can be easily installed in any context and capable of producing genuine crops (Zero Farms, n.d.).

The last relevant case we will mention is linked to drip irrigation. This particular technique, despite having German origins, became the flagship of the new-born state of Israel in the mid-fifties⁴¹. This is how the market leader “Netafim” (an Israeli company) describes this process (Netafim, n.d.). It delivers water and nutrients directly to the plant’s root area, in the right quantity and time, so each plant gets exactly what it needs and when it needs it, to grow optimally. It helps farmers to produce higher yields while saving on water as well as fertilizers, energy, and even crop protection products. Water is delivered across the field in pipes called “dripper lines” featuring some smaller units known as “drippers”. Each dripper

³⁹ This book became the reference point for many companies as it will be illustrated shortly.

⁴⁰ Cloud-based AI, on duty 24/7, to learn from farmers, agronomists, and engineers. It hacks yield and flavor, controls the environment, sees the growth, gathers data up to the point that it can predict what is going to happen. Moreover, it gets its performances better and better over time.

⁴¹ Israel is located on particularly arid land and water management in agriculture was one of the priorities of the new-born state, thus leading to the development of advanced technologies and companies.

emits drops containing water and fertilizer, resulting in the uniform application of water and nutrients directly to each plant's root zone, across an entire field. All this allows for higher constant quality yields, enormous water savings (no evaporation and no drainage), 100% land use regardless of topography and soil type, energy savings by operating at low pressure, efficient use of fertilizers, crop protection, and less dependence on the weather.

4.3 - How to obtain clean energy from water

After showing some interesting aspects related to the use of water in agriculture, we will now draw attention to the use of this element in the secondary sector, especially considering the energy sector. According to the European Environment Agency and taking Europe just as a reference model, although agricultural water use percentage is still the highest⁴², the second place goes to the production of energy together with the manufacturing industry (40%) (EEA, 2020). For the latter, it is sufficient to show the data relating to the three industrial sectors that consume the most water in Italy, namely the chemical sector (681 million m³), followed by the rubber and plastics sector (645 million m³), and by the steel, mining and base metals sector (552 million m³) (Aterini, 2016). As for the production of energy linked to water, hydroelectric and thermal systems are still the most important. The former involves storing water behind a dam or a tank to use its hydraulic energy to move the turbines; the latter uses water to cool the hot steam used to move the turbines. Hydroelectric energy is the most exploited of the two and constitutes 90% of the world's production of electricity from renewable sources. For this reason, in some countries, this energy covers most of the energy needs, for example in Norway (99%), New Zealand (75%), Austria, Switzerland, Canada, Iceland, and Sweden (> 50%). In Italy, instead, the hydroelectricity percentage reaches only 15%, even if there is a strong variation especially between the northern and southern regions (*Energia idroelettrica protagonista in Italia e nel mondo*, 2018).

This is an excellent starting point for the European Green Deal aiming for zero emissions in 2050 but an even greater effort is required. Indeed, other alternatives need to be further developed using the sun, wind, and waste. Regarding water, it is still possible to optimize hydroelectricity and harness the energy coming from tides, waves, and sea currents. Future developments in hydroelectricity will concern improvements in the flexibility of systems, dealing with the ability to maintain high efficiencies even when the flow rate varies.

⁴² The value related to water use in agriculture drops here to 44%, compared to the global 70%.

Moreover, further developments in the micro-hydroelectric sector are foreseen, developing systems with considerably reduced dimensions, with a capacity between 5 and 100 kW. A project that deserves to be mentioned is the “DesignPro Renewables”⁴³. Its main objective is the development and commercialization of a range of small-scale hydrokinetic turbines that would allow many users to harness the clean energy of water flowing in rivers and estuaries. Thanks to the financing of 2.7 million euros, two pilot devices were implemented and became operational in 2017. However, other systems with water wheel and Archimedean screws can still be improved.

One last aspect to be stressed concerns marine energy, coming from currents, tides, and waves. These three typologies will be now explained referring also to some projects already realized or under study. The first one is defined as the kinetic energy produced by the huge masses of water in motion creating sea or ocean currents. At the fluid dynamic level, currents are immense flows of water that possess unique physical-mechanical characteristics, having their own density, salinity, and temperature as well as a relatively constant direction and speed. The principle that aims to obtain energy from currents is almost the same that is used to exploit wind power. Wind, like water, is a fluid that, thanks to its kinetic energy, can move blades and generate mechanical energy. In Italy, there is one of the most interesting sites of energy from marine currents still to be exploited: the Strait of Messina. Geographically, the place is characterized by very fast and localized currents (1.5m/s on average). The second type of marine energy is the energy generated from the water displacements caused by tides. Scientifically, tides refer to the cyclical rise and fall of the sea level, caused by the gravitational action of the moon and sun. Usually, in most of the world, it has a width of less than one meter, although it strongly depends on the area and configuration of the site. In some areas of the planet, there are in fact very high differences in height (up to 20m), and it is right in these places that the exploitation for energy is more effective. In Italy, since 2013 there is an interesting tidal energy site in Tuscany at Punta Righini. At the European level, the most developed case is Saint-Malo, in France. Located at the mouth of the Rance river and built in the Sixties, the power plant can exploit a particularly large tide reaching up to 13.5m in altitude. The flow rate reaches about 18,000 cubic meters of water per second, with a maximum deliverable power of 240 MW. Each year, the power station covers 3% of Brittany's electricity needs. The third type of marine energy, instead, exploits the kinetic energy contained in the motion of the waves.

⁴³ This project has been financed by the European Union thanks to the Horizon2020 (H2020) program. Link to the official website: <https://designprorenewables.com/>

There are different techniques for exploiting wave motion, based on different physical principles such as water jump, oscillating water column generator, undulatory, and Archimedes systems. In Europe, the Pelamis generator off the coast of Póvoa de Varzim in North-Portugal has already been in use for years. It consists of floating tubular structures anchored to the seabed by three snake-shaped Pelamis P-750 machines with a capacity of about 2.25 MW of power (*Energia marina: Cos'è, Come funziona e Come si produce*, n.d.).

4.4 - Ancient but futuristic ways across the water

After showing some other interesting aspects related to the use of water in the industrial and energy sectors, the focus will now shift to the use of this element in the tertiary sector, especially considering the communication sector. Indeed, even if it is still essential for health⁴⁴ and home use, transportation can benefit the most from a renaissance water-based.

Rethinking mobility in a sustainable way, that is, how to move while reducing pollution, is certainly one of the post-pandemic objectives. In this regard, an alternative form of freight transport satisfying this requirement already exists, even if it is greatly underestimated. It uses inland waterways, that is navigable rivers and canals, either artificial or natural, connected to each other, which can be defined with the term waterways. A system like this would make it possible to carry large quantities of goods from one place to another. If a barge in a navigable canal can carry assets corresponding to more than 80 trucks, then the ecological, economic and road convenience is evident. At a time when countries think about big “green” changes, however, too little has been said about navigable roads. Nevertheless, Italy has always been rich in tools suitable for use in the transfer of goods through waterways, thanks to a past in which this transport system was more used⁴⁵, at a time when the use of “rubber” was not dominant as it is now. The navigation of goods on inland waterways is now more than residual: three-quarters of land freight transport travels by road (76.4%) and less than a fifth (17.4%) by rail; the remaining share (6.2%) should move through inland waterways (De Ceglia, 2019). But that 6.2% attributed data is not very credible: air transport is not considered in that percentage and for many technicians transport “by water” is trifling, while more than 90% is actually made by road.

⁴⁴ In this sense, the high importance of water has been evident, being the first weapon against Covid. Hand washing for at least 20 seconds was the best international health advice since March 2020.

⁴⁵ In the North and Centre of Italy more by river, while in the South of Italy more by sea.

In Italy, 67% of the total transport volume is concentrated in four regions: Piedmont, Lombardy, Emilia-Romagna, and Veneto. However, although the motorway network has long proved to be insufficient and too polluting, no investments to improve river transportation were made. Little or nothing has been done to keep river navigation alive, which has also been extremely important for centuries for the entire Po Valley. However, a counter-trend signal occurred in July 2020 when the Chamber of Deputies promoted a joint motion for the conclusion of the Padua-Venice waterway (Regione del Veneto, 2020). This work was designed in the early 60s of the last century, to connect the industrial area of Padua to that of Marghera, across the Brenta river and the Novissimo canal, for a distance of about 28 km. Only 10.7 km of the canal foreseen by the project elaborated by the Civil Engineers of Venice have been built between Padua and the Brenta and between the Novissimo and the lagoon. Completing the construction of the waterway would mean creating an essential and significant work in the heart of the Veneto metropolitan area⁴⁶. Of course, respecting the environment, with care and attention to the landscape, which must be greatly enhanced, also by developing slow-tourism paths and sport activities nearby these waterways (Malamocco, 2020).



Figure 9 – Waterways: navigable canals and rivers, a forgotten alternative to road transport
 Source: Geograficamente.com - Year: 2020

Other than that, there is even an Italian organization that deals specifically with this issue and that represents a European model. It is the “Unione Navigazione Interna Italiana” (UNII) based in Marghera-Venice. It is a national non-profit association that works for the strengthening, coordination, and development of inland and river-maritime navigation in Italy, both for tourism and freight transport. This association is made up of both public

⁴⁶ This the so-called PaTreVe area of Padua, Treviso and Venice, important for trade and industry.

bodies (regions, municipalities, provinces, port companies, industrial development consortia) and private individuals (companies and business organizations) interested in inland navigation. UNII was established in 1919 but it was legally recognized by Ministerial Decree only in 1992. It was subsequently associated with the Federation of European Inland Ports, based in Brussels, where in 2011 the inland navigation system from Trieste to Milan was included in the European Ten-T network. This network is divided into two levels: the core network and the global network, the latter being the network of all Europe, and the first one being just a selection of its main parts to be implemented by 2030. It gathers 85 economic centres and related airports, 138 maritime and inland ports, 28 border points with third countries. This is where the greatest flows of goods and passengers will pass by in the incoming future. Until 2030, the European Union will make about 500 billion euros available, 250 of which have already been given in 2020 (UNII, 2015). An emblematic example of this waterway project is the Locarno-Milan-Venice-Trieste-Koper route⁴⁷, rich in minor tributaries, including the one that passes through Battaglia Terme, in the southern area of Padua next to the Euganean Hills, home to the most important European Museum on Inland Navigation⁴⁸. This place offers an excellent historical itinerary of the area and river navigation, through an internal path full of objects⁴⁹.

A final aspect to consider before concluding this chapter concerns maritime transport. It is already widely used, and it has historically been one of the preferred goods handling systems for import-export. Even today, it is very popular for the shipment of large batches of goods. On the one hand, one of the advantages of maritime transport is undoubtedly its convenience, being able to reduce the cost per unit, as it has a greater range than any other transport by road or air. On the other hand, however, one of the worst drawbacks concerns timing. Shipping by sea becomes a useful and functional system only for those who do not have urgency, as with air transport almost any good is available in 24 hours (Napoli, 2020).

On this note, we have reached the conclusion of the first part of the present master's thesis. The most relevant theoretical aspects relating to the proper functioning of water have been illustrated. The aim was to propose a more sustainable society by involving multiple approaches, touching many organizations and finding a common thread even between very distant sectors. In the second part of this thesis, the attention will focus on the cultural side, moving from a general overview to the analysis of two case studies.

⁴⁷ It is long at least 600 kilometres, and it is one of the busiest car areas in Europe.

⁴⁸ This museum is part of the Water Museum of Venice network previously mentioned.

⁴⁹ Link to the official website: <https://museonavigazione.eu/it/>

Chapter 5 - Water for UNESCO sites: history and nature together

The second part of this thesis will go beyond the general discussion presented so far, in order to focus on more practical and localized aspects. The cultural side of this work⁵⁰ will be properly explored in the following sections. Firstly, the main criteria for which a place becomes part of the UNESCO world heritage list will be briefly described. This introduction will serve as a basis to show which of the sites in Italy and Germany⁵¹ have a certain correlation with water, making short comparisons⁵² between some of them in the following two chapters, to present a general overview. The main purpose of this analysis is to demonstrate that the presence of water in a place has a strong correlation with the possibility of being part of the UNESCO list. This is because, as mentioned several times in this work, man has always lived in close contact with this element, which has positively influenced the history, taste, and development of all mankind. Finally, two further chapters will be dedicated to the detailed illustration of two more sites linked to how water contributed to their official UNESCO recognition, namely “Venice and its Lagoon” in Veneto and the “Water Management System of Augsburg” in Bavaria.

An essential starting point to begin with is the 1972 UNESCO Convention for the Protection of the World Cultural and Natural Heritage. It defines the different types of sites to be included in the World Heritage List, establishing the duties of the member states in identifying the sites, as well as their role in safeguarding and conserving them. It is curious to note how this milestone was reached thanks to a potentially critical situation linked to water, following the decision to build the Aswan dam in Egypt with the consequent flooding of the valley where the temples of Abu Simbel stood, treasures of the ancient Egyptian civilization. In 1959, after an appeal from the Egyptian government, UNESCO initiated an international protection program. Soon after, archaeological research was carried out in the flooded areas, and, more significantly, the temples of Abu Simbel and Philae were dismantled, transported to dry land, and reassembled. The campaign cost was about 80 million dollars. Half of the sum was donated by about fifty countries implementing, maybe for the first time together, an important act of solidarity and co-responsibility for the protection of exceptional cultural heritage. The relocation of the temples lasted five years, from 1964 to 1968. It took about the same time to “codify” what

⁵⁰ This section better reflects my field of study, related to artistic and cultural activities.

⁵¹ The chosen countries are functional to the case because rich in both similarities and differences.

⁵² Nine different comparisons will be presented on this topic, adding one for the two case studies.

was experienced on that occasion in the 1972 Convention (UNESCO, 1972)⁵³. The most important aspect highlighted in this document is that any site on the UNESCO list has an “outstanding universal value” (OUV), which means that those places are selected for their specific characteristics, which make them the best possible examples of the cultural and natural heritage of the entire world. Originally, the evaluation of this OUV was only based on two heritage factors relating to culture and nature.

As a matter of fact, article 1 of the 1972 UNESCO Convention defines cultural heritage as:

- Monuments: monumental architectural, plastic, or pictorial works, elements or structures of an archaeological nature, inscriptions, caves, and groups of elements of exceptional universal value with a historical, artistic, or scientific aspect;
- Agglomerations: groups of isolated or combined buildings which, due to their architecture, unity, or integration into the landscape, have an exceptional universal value from the historical, artistic, or scientific aspect;
- Sites: works of man or conjugated works of man and nature, as well as areas, including archaeological sites, of exceptional universal value from the historical and aesthetic, ethnological, or anthropological aspect.

Article 2 of the 1972 UNESCO Convention defines instead natural heritage in three ways:

- Natural monuments consisting of physical and biological formations or groups of such formations of exceptional universal value with an aesthetic or scientific aspect;
- Geological and physiographic formations and the strictly delimited areas constituting the habitat of threatened animal and plant species, of exceptional universal value from their scientific or conservative appearance;
- Natural sites or strictly delimited natural areas of exceptional universal value from a scientific, conservation or natural aesthetic aspect.

Furthermore, the Operational Guidelines for the implementation of this Convention have been elaborated since 1977. These recommendations are periodically updated. For example, in 1992, it was decided to add mixed heritage for assets corresponding in part or wholly to both definitions of cultural and natural heritage. Moreover, in the same year, cultural landscape was included considering those cultural assets that represent “the joint work of

⁵³ The idea of an international movement to protect heritage was born after World War I in academia, and even more after the destruction of World War II. In the 1972 Convention relating to the Protection of the World Cultural and Natural Heritage, two distinct movements converged in a unique document: the first part was focused on the protection of cultural sites, while the second part focused more on the protection of nature including animals and plants.

man and nature” as defined in Article 1 of the Convention (UNESCO, 1972), and that illustrate the evolution of a society and its establishment over time under the influence of constraints and/or opportunities presented, internally and externally, by the environment and by cultural, economic and social impulses. The same document mentions the ten criteria⁵⁴ (article 77) for evaluating a new site, divided into six cultural criteria and then into four natural ones.

This is the complete list of criteria (UNESCO WHC, 2019):

- Represent a masterpiece of man's creative genius;
- Show a relevant interchange of human values over a long time or within a cultural area of the world, on the developments of architecture, technology, monumental arts, urban planning, and landscape design;
- Be a unique or exceptional testimony of a living or vanishing cultural civilization;
- Constitute an extraordinary example of a building typology, an architectural or technological ensemble, or a relevant landscape for human history;
- Be an exceptional example of a traditional human settlement, of the use of territorial or marine resources, representative of a culture or of the interaction of man with the environment, especially when there is a criticism due to irreversible changes;
- Be directly or materially associated with living events or traditions, ideas, or beliefs, artistic or literary works of outstanding universal significance;
- Present exceptional natural phenomena or areas of exceptional natural beauty;
- Constitute an extraordinary testimony of the main periods of the earth's evolution, including evidence of life, of geological processes relating to the physical characteristics of the earth's surface or of significant physiographic characteristics;
- Establish significant examples of important ecological and biological processes in the evolution of terrestrial, freshwater, coastal, and marine ecosystems and environments;
- Present the most important and significant natural habitats suitable for the in-situ conservation of biological diversity, including those in which survive threatened species of outstanding universal value from the point of view of science or conservation.

This preamble will help us understand how the UNESCO sites of Italy and Germany were chosen. To maintain water as the common thread, as in the first part of this thesis, in the

⁵⁴ The more a place meets the greater number of criteria, the more it has the possibility of being chosen to be listed as a World Heritage.

following paragraphs we will especially analyze those places that have a specific relationship with this element, comparing those that have evident similarities in their history or traditions.

5.1 - The prehistoric pile-dwelling sites of the Alps in Italy and Germany

The first comparison is perhaps the simplest because it concerns the same typology of places. These are 111 pile-dwelling archaeological sites⁵⁵ shared by several countries in the Alps, including France, Switzerland, Austria, Slovenia, Germany, and Italy. These sites are composed of the remains of prehistoric settlements dating back to the period between 5000 and 500 BC. They can be found underwater, on the shore of a lake, along rivers, or in humid areas. The exceptional conditions of conservation of many organic materials combined with costly archaeological research⁵⁶ have allowed a detailed reconstruction of the world of the first agricultural societies along the Alpine Arc in Europe. In this way, more precise information was obtained, for example on agriculture, animal husbandry, and the development of metallurgy, over a period of more than four millennia. It is interesting to note that these stilt houses, organized in groups or villages, were huts supported by poles and equipped with a horizontal wooden platform that was erected only where there was some water. Such an arrangement had several advantages: from the adaptation to variations in water levels, and the availability of sources of water and food nearby, to defensive functions against enemies and wild animals. In addition to its incredible historical-cultural importance, this site also constitutes a perfect example of transnational collaboration that has allowed the creation of an exceptional network. There is even a group called “Palafittes Organization” that deals with the preservation and enhancement of these places only, aiming to digitize as many sites as possible by the tenth anniversary of the UNESCO selection (falling at the end of June 2021), and to propose articles, events and routes (also underwater) to sensitize people on this past, still too unknown.

19 of these 111 sites⁵⁷ are located in northern Italy, precisely in five regions: Lombardy (10), Veneto (4), Piedmont (2), Friuli (1), and Trentino (2). This is the complete list of the sites, according to the interactive map available online⁵⁸.

⁵⁵ Link to the official website: <https://whc.unesco.org/en/list/1363/>

⁵⁶ From the excavations, numerous finds have emerged, often in excellent conditions (bone combs, ambers, needles and tools for weaving, hoes, plows, food remains, votive statues, crucibles, axes, points, and blades), testifying to the habits and activities practiced by prehistoric European men.

⁵⁷ They were chosen according to criteria 4 and 5 of the Operational Guidelines.

- In Friuli: Palù di Livenza-Santissima, near Caneva/Polcenigo (PN);
- In Lombardy: Lavagnone Basin in Desenzano del Garda (BS), San Sivino-Gabbiano in Manerba del Garda (BS), Lugana Vecchia in Sirmione (BS); Lucone in Polpenazze del Garda (BS); Lagazzi del Vho in Piadena (CR), Bande-Corte Carpani in Cavriana (MN), Castellaro Lagusello - Fondo Taccoli in Monzambano (MN), Isolino Virginia - Camilla - San Biagio Island in Biandronno (VA), Bodio centrale o delle monete in Bodio Lomnago (VA) and Il Sabbione o settentrionale near Cadrezzate (VA);
- In Piedmont: Azeglio-Viverone lake (TO/BI) and Mercurago in Arona (NO);
- In Trentino: Molina di Ledro in Ledro (TN) and Carera Lake Biotope in Fiavè (TN);
- In Veneto: Belvedere in Peschiera del Garda (VR), Frassino in Peschiera del Garda (VR), Tombola in Cerea (VR) and Laghetto della Costa in Arquà Petrarca (PD).



*Figure 10 – Prehistoric pile-dwelling sites in the Alps
Source: Unescopalafitteitalia.beniculturali.it - Year: 2019*

18 sites are located instead in South-Germany, precisely in two regions: Baden-Wurttemberg (15) and Bavaria (3). This is the complete list of the sites:

- In Baden-Wurttemberg: Wangen-Hinterhorn in Öhningen (Freiburg-FR), Hornstaad-Hörnle in Gaienhofen (FR), Allensbach-Strandbad in Allensbach (FR), Bodman-Schachen/Löchle near Bodman-Ludwigshafen (FR), Wollmatingen-Langenrain in Oberzell (FR), Konstanz-Hinterhausen in Constance (KN), Litzelstetten-Krähenhorn near Costance (KN), Sipplingen-Osthafen near Sipplingen (Tübingen-TÜ), Unteruhldingen-Stollenwiesen near Uhldingen-Mühlhofen (TÜ), Ödenahlen near Seekirch (TÜ), Grundwiesen near Alleshausen (TÜ), Siedlung

⁵⁸ Link to the interactive map: <https://www.palafittes.org/interactive-map.html>

- Forschner near Oggelshausen (TÜ), Olzreute-Enzisholz in Bad Schussenried (TÜ), Schreckensee near Wolpertswende (TÜ) and Ehrenstein near Ulm (TÜ);
- In Bavaria: Pestenacker near Weil (Landsberg am Lech-LL), Unfriedshausen near Weil (LL) and Roseninsel near Feldaing (Starnberg-STA).

5.2 - The Italian Maritime Republics and the German Hanseatic League

The second comparison is more closely linked to the history of Italy and Germany, two countries that share a long maritime commercial tradition due to their position, the first in the Mediterranean Sea and the second in the Baltic Sea.

Speaking of Italy, four cities had a greater vocation in this respect, so much so that they were called “maritime republics”⁵⁹ and their symbols have been reported since 1947 in the flags of the Navy and Merchant Navy. They are Amalfi, Pisa, Genoa, and Venice. The main features that characterized a maritime republic were its economic-political autonomy (based on maritime trade) and the possession of a fleet of ships built in its own arsenal. This led to the birth of rich city-states, whose presence in Mediterranean ports was guaranteed by their warehouses, and whose influence was revealed during the Crusades and/or the repression of piracy. Furthermore, a republican government ensured prosperity through its own currency and special maritime laws (Bragadin, 2010). It is no coincidence that all the four cities are included in the UNESCO World Heritage List considering their trade history and cultural heritage. Following the chronological order, Venice and Pisa were the first to become part of the UNESCO heritage, in 1987. As for Venice and its Lagoon, it is not necessary to talk about it now⁶⁰ as the entire seventh chapter is dedicated to this site. Speaking of Pisa⁶¹, it can be said that the city overlooks a wide bend of the Arno. Not far from this river, the “Piazza del Duomo” stands out with four buildings that are masterpieces of medieval architecture: the Cathedral, the Baptistery, the Bell Tower, and the Cemetery, known as “Campo Santo”. The construction of this chefs-d’œuvre was made possible during the golden age of the city when Pisa dominated the Tyrrhenian Sea around the 12th century (Commissione Nazionale Italiana per l'UNESCO, 2021). The third site in chronological order is the Amalfi Coast⁶², a UNESCO heritage site since 1997. Located near Naples, along the Tyrrhenian coast, it is an area of great natural beauty, characterized by terraces

⁵⁹ There were, in truth, other minor ones such as Ancona, Gaeta, Noli, and Ragusa (in Dalmatia).

⁶⁰ Venice was chosen according to criteria 1, 2, 3, 4, 5, and 6 of the Operational Guidelines (OG).

⁶¹ The city of Pisa was chosen according to criteria 1, 2, 4, and 6 of the OG.

⁶² The Amalfi Coast was chosen according to criteria 2, 4, and 5 of the OG.

with vineyards and towns of great architectural and artistic value. The area includes twelve municipalities and multiple historical and artistic testimonies that represent the identity of its origins, all immersed in an idyllic atmosphere full of gardens that plunge over the sea (Commissione Nazionale Italiana per l'UNESCO, 2021). The latest site is Genoa⁶³, a UNESCO heritage site since 2006. This city is still one of the main European ports today and the same can be said for its aquarium. However, it was during its heyday⁶⁴ that Genoa started a public noble residential project for the construction of a system of new streets and representative buildings (Commissione Nazionale Italiana per l'UNESCO, 2021).

Many similarities with the maritime republics can be found in the “Hanseatic League”. Born in the mid-fourteenth century, it consisted of an alliance of about 100 northern European cities with a relative trade monopoly between Germany, Scandinavia, the Baltic countries, and Russia. For about 300 years, the so-called “Hansetag” (a diet of the Hanseatic League) was regularly convened until its dissolution in 1669. Nonetheless, after 300 years, the tradition of the League is still alive. The New Hanseatic League (official name: Städtebund Die Hanse) was founded in 1980. In this way, 190 cities from 16 northern European countries have forged a “new” alliance to foster cultural, economic, commercial, and tourist exchanges. Speaking of Germany, many cities are part of this league, and among these five are UNESCO sites, divided into four groups: Lübeck, Hamburg, Bremen, and Wismar-Stralsund (Pruscha, n.d.). Following the chronological order, Lübeck⁶⁵ became part of the UNESCO heritage in 1987. This city was the capital of the Hanseatic League, so much so that it was called “the Queen”. Founded by Count Adolfo II of Holstein in 1143 on a small island on the Baltic Sea coast, near the estuary of the River Trave, it soon experienced an extraordinary commercial rise. The historic center, developed on a hill and protected by the river, is crossed by two main roads, dating back to the time of the city's foundation, and is made up of three areas, which were damaged by the bombardments of the Second World War and then successfully recovered. Then, there are Wismar and Stralsund⁶⁶, which entered the prestigious UNESCO list in 2002, as important ports in the period of the Hanseatic League. Wismar⁶⁷ is remembered especially for its old market square, the largest in Germany, overlooked by buildings of the time, together with the “Wasserkunst”, a wrought-iron fountain imported from the Netherlands in 1602.

⁶³ The city of Genova was chosen according to criteria 2 and 4 of the OG.

⁶⁴ Thanks to trade, with the rich Spanish kingdom in the sixteenth century.

⁶⁵ The city of Lübeck was chosen according to criteria 4 of the OG. Link to the official website: <https://whc.unesco.org/fr/list/272/>

⁶⁶ The cities of Wismar and Stralsund were chosen according to criteria 2 and 4 of the OG.

⁶⁷ Link to the official website: <https://whc.unesco.org/en/list/1067/>

Stralsund, instead, is located on the southern coast of Strelasund, near Poland. Of relevance are the numerous churches and convents, together with the old market square, surrounded by the monuments of the time. In 2004 it was Bremen⁶⁸ – nestled on the river Weser – to obtain this international recognition. Of particular importance is the Statue of Roland (1404) and the old town hall erected in the Gothic style in the 15th century, after Bremen entered the Hanseatic League, and renovated at the beginning of the 17th century in the “Weser Renaissance” style. At the beginning of the 20th century, a new town hall was built after the heavy bombings of the Second World War. The last site of this group is Hamburg⁶⁹, located on the Elbe River estuary and part of the UNESCO list since 2015. This city is defined as a “Venice of the North” as it is crossed by a dense network of canals (Fleete) and it is surrounded by two artificial lakes formed by the Alster (Lake Binnenalster and Lake Außenalster). The UNESCO site, however, covers only two areas⁷⁰. The first, the Speicherstadt, originally developed on a group of islands, holds one of the largest port warehouse complexes in the world (300,000 m²). The second, the Kontorhaus, covers an area of five hectares to house port-related businesses. All these cities had a close link with rivers and sea for trade reasons, still relevant today.

5.3 - Vineyard landscape of Veneto-Liguria and the Upper Middle Rhine Valley

The third comparison we will draw is linked to an element strongly rooted in both Italy and Germany: wine.

As for the first country, the history of viticulture dates to the 10th century BC, thanks first to the Phoenician and then the Greek colonization. Subsequently, the production developed further during the Roman period, so much so that the Italic area was called “Enotria tellus” (the land of wine) thanks to the Mediterranean climate and the mountain air currents that favored the growth of vines. In this period the wine was diluted with water⁷¹ due to the strong alcohol content. With the fall of the Roman Empire and the barbarian invasions, viticulture suffered a sharp decline, and in the late Middle Ages, it became a prerogative of monasteries. We need to wait until the Renaissance to witness the rebirth of Italian wine,

⁶⁸ The city of Bremen was chosen according to criteria 3, 4, and 6 of the OG. Link to the official website: <https://whc.unesco.org/en/list/1087/>

⁶⁹ The city of Hamburg was chosen according to criteria 4 of the OG.

⁷⁰ Link to the official website: <https://whc.unesco.org/en/list/1467/>

⁷¹ There was also a personality – the “magister bibendi” – who established every time what the right proportion between water and wine was, and the number of glasses that could be drunk. The percentage of water always exceeded that of wine (generally 65% the former and 35% the latter).

with successive fluctuating periods of collapse and recovery. In the 1970s, the great revival that still continues today began. Indeed, in the last fifty years, Italian viticulture has undergone more changes than in the previous three centuries. Currently, Italy is the largest wine producer in the world, with 50.4 million hectoliters of wine in 2018, a revenue of 11 billion euros, and 19.8% of the entire world export. The regions that hold most of the share of wine production in Italy are Tuscany, Piedmont, Puglia, Sicily, Emilia, Liguria, and Veneto (Battistoni, 2019). In particular, Veneto and Liguria have two UNESCO sites, intended as cultural landscapes, directly linked to wine production. The first concerns the Prosecco hills⁷² in the Conegliano and Valdobbiadene area. This area is characterized by hilly ridges, “ciglioni” (small vineyards on narrow grassy terraces), forests, villages, crops, and aquatic areas such as the Piave river together with other streams and numerous resurgences. For centuries, this harsh terrain has been shaped by man. Since the 17th century, the use of “ciglioni” has created a particular checkerboard landscape formed by rows of vines parallel and vertical to the slope. In the 19th century, the vine cultivation technique called “bellussera” has contributed to the composition of the aesthetic characteristics of the landscape. The result of these environmentally friendly practices is reflected everywhere: the vineyards coexist with many small woods, waterways (such as the “road of the mills”), and fortified villages (Commissione Nazionale Italiana per l'UNESCO, 2021). The second UNESCO site concerns the Riviera di Levante, precisely 15 kilometers of the Ligurian coast⁷³. Here the rugged and steep coastal landscape has developed over the centuries with stone-walled terraces for the cultivation of vines and olives. The area was almost inaccessible, except by sea, until the construction of the Genoa-La Spezia railway in the 1870s. The property, which extends from Punta Mesco to the west and up to Punta Persico to the east, includes the territory of Porto Venere, the three islands of its archipelago (Palmaria, Tino, and Tinetto), and the Cinque Terre, including the five towns of Monterosso, Vernazza, Corniglia, Manarola, and Riomaggiore. The maintenance of the terraces and the related cultivation of vines and olives reflect a sustainable community approach to agriculture based on the collaboration and cooperation of the communities without which such cultivation would not have been possible there.

As for Germany, here too there was a long wine-making tradition of Roman origin along the Rhine and Moselle, which persisted until the time of Charlemagne. Later, as already mentioned before, just the monasteries maintained this tradition. However, this situation did

⁷² The Prosecco Hills of Conegliano-Valdobbiadene were chosen according to criteria 5 of the OG.

⁷³ The area of the “Portovenere, Cinque Terre and the Islands (Palmaria, Tino and Tinetto)” was chosen according to criteria 2, 4, and 5 of the OG. Link to the official website: <https://whc.unesco.org/en/list/826/>

not last long, and an inevitable decline followed, also due to beer competition. Only in the 19th century, the sector began to flourish again, also developing countermeasures to parasites such as the phylloxera, until the last developments of the late 20th century (Leder, 2020). The areas that today present important winegrowing are located along the Elbe and Rhine. UNESCO decreed that both areas shall be part of the World Heritage List, however today only the Upper Middle Rhine Valley has retained this recognition. In fact, the Dresden Elbe Valley⁷⁴ has been delisted in 2009 due to the controversial construction of a modern bridge over the river, the so-called “Waldschlößchenbrücke”, which irreversibly damaged the place, therefore failing the previously used selection criteria (especially points four and five of the OG). A long legal battle ensued between the municipality, the region, and UNESCO itself but this did not change the decision. Consequently, this site has unfortunately become famous for being the second delisted site in the world (the first was Oman’s Arabian Oryx Sanctuary in 2007) and the first in Europe (UNESCO WHC, 2009). Eventually, only the Upper Middle Rhine Valley⁷⁵ currently maintains this status. Its strategic location along the 65km between Bingen, Rudesheim, and Koblenz does not represent only a transport artery but it also offers a unique panoramic landscape, encompassing sixty small towns, extensive terraced vineyards, and ruins of the castles that once defended the area and guaranteed trade. As a transport route, the Rhine has served as a link between the southern and northern halves of the continent since prehistoric times, allowing for trade and cultural exchanges, which in turn led to the creation of settlements. For a thousand years, the steep sides of the valley were then terraced for vineyards, giving birth to wines such as the “Montuni”. The following wars and decadence of the 17th century had left most of the buildings in ruins. This made the area very suggestive, especially for the artistic romantic movement in the 19th century. Here the importance of water appears even more evident than in the Italian cases.

5.4 - The Aeolian Islands and the Frisian Islands in the Wadden Sea

The fourth comparison is linked to two groups of islands that could keep their essence intact over time, sometimes reaching an atemporal dimension, in a period where the biosphere is in danger worldwide. This is the case with the Aeolian Islands in northeastern Sicily and the Frisian Islands in the Wadden Sea in northwestern Germany.

⁷⁴ The Dresden Elbe Valley was chosen according to criteria 2, 3, 4, and 5 of the OG.

⁷⁵ The Upper Middle Rhine Valley was chosen according to criteria 2, 4, and 5 of the OG. Link to the official website: <https://whc.unesco.org/en/list/1066/>

As for the Italian case, the Aeolian Islands are seven – Lipari, Vulcano, Salina, Stromboli, Filicudi, Alicudi, and Panarea – and they are significantly old (from 700.000 to 50.000 years old). They were inscribed on the UNESCO World Heritage List in 2000 because they represent an extraordinary testimony of the birth and evolution of the volcanic islands. Moreover, this area⁷⁶ presents an uncontaminated environment, rich in flora and fauna with wonderful beaches, caves, inlets, stacks, and with a great variety of seabeds. Besides, its frequent eruptions attract tourists from all over the world, making them feel that sense of fear and visual pleasure that Romantics identified with the term “sublime”. This paradise, however, presents a major problem concerning access to drinking water. An attempt to solve this issue has been recently made by investing heavily in desalination and purifiers plants, as the so-called barges, small ships for carrying water especially in summer, are no longer conceivable from a sustainable point of view (Calio, 2019). This issue already existed at the time of the first human settlements in Lipari and Salina, dating back to a few centuries before 4000 BC, when obsidian⁷⁷ was in great demand. Obsidian trade brought long prosperity to the islanders, especially during the Greek period, when it was said that this archipelago housed the wind god Aeolus and the site of the forge of the god Hephaestus. Later, the study of the islands, which started during the 18th century, provided volcanology with the definition of two important types of eruptions, the Vulcan⁷⁸ and the Strombolian⁷⁹, continuing even today to enrich this fascinating science (Commissione Nazionale Italiana per l'UNESCO, 2021).



*Figure 11 – How to see Stromboli eruptions from the sea
Source: Magazine.snav.it - Year: 2018*

⁷⁶ The Aeolian Islands were chosen according to criteria 8 of the OG.

⁷⁷ It is a volcanic glass, formed by the cooling of the lava, which was once the sharpest material.

⁷⁸ Explosive eruptions, with the emission of lava bombs and clouds of gas laden with ashes.

⁷⁹ Basaltic magmas, on average viscous, cause lasting activity with regular emission of lava fountains that reach the height of hundreds of meters together with the launch of lapilli and volcanic bombs.

As for the German case, the insular environment we will discuss is not of volcanic but sandy origin. In some ways, it presents many characteristics similar to the Venice lagoon. UNESCO inscribed the Wadden Sea⁸⁰ on the World Heritage List in 2009 as the largest uninterrupted system of intertidal expanses⁸¹ of sand and mud in the world, with undisturbed natural processes in most of the area. This area is relatively young compared to the Aeolian Islands, being less than 10,000 years old. It stretches from Den Helder in the Netherlands to Esbjerg in Denmark, for a total length of 450 km, and a width of between 5.5 and 30 km. It is limited by the mainland coast to the south and the Frisian Islands to the north. In particular, these islands are a popular tourist destination, reachable by boat, but also on foot at low tide, as they are connected to the coast by a strip of muddy land called “Wattwanderung” in German⁸². The whole area includes a multitude of transition zones between land, sea, and freshwater environment and is rich in species adapted to the harsh environmental conditions. It is considered one of the most important areas in the world for migratory birds. Its importance is not limited to the context of the East Atlantic Flyway only, as it plays a critical role in the conservation of Afro-Eurasian migratory waterfowl. This site is also part of the “World Heritage Marine Program” which brings together 50 marine protected areas from 37 countries that can count on a strong “outstanding universal value” (OUV) and can bring therefore signs of hope for a more sustainable ocean. This project develops reports on the marine conservation status of the areas involved, focusing above all on combating climate change. The starting point is of course the guidelines of the 1972 UNESCO Convention, but its real success depends on the vast global network of collaboration and activities (UNESCO WHC, n.d.c.).

⁸⁰ The Wadden Sea was chosen according to criteria 8, 9, and 10 of the OG. Link to the official website: <https://whc.unesco.org/en/list/1314/>

⁸¹ The coastal area that depends on the tides, as it emerges at low tide and is submerged at high tide.

⁸² Link to the official website: <https://www.nationalpark-wattenmeer.de/>

Chapter 6 - Water for UNESCO sites: architecture and nature together

In the previous chapter, we have illustrated four comparisons concerning the relationship between some historical areas and the natural surroundings around them (especially water-related). Various areas have been mentioned, such as the cultural, commercial, touristic, scientific, and food and wine sectors, always looking at their geographical and temporal context. In the following five comparisons, some sites more related to architectural and natural integration by man will be analyzed. As far as Italy is concerned, the focus will be on the Renaissance beauties⁸³ such as cities, villas, and gardens that have a strong relationship with water. As for Germany, instead, the historical period considered will be much more ambitious, starting from the Middle Ages with Bamberg, passing then through baroque spaces in Kassel and parks-gardens of the 19th century in the eastern area, and finally arriving at the royal palace of Berlin and Potsdam. There will also be the opportunity to cite some other water-related sites that are waiting to be evaluated to enter the UNESCO World Heritage List, obtaining more economic, political, and touristic visibility.

6.1 - The city of Mantua with Sabbioneta and the town of Bamberg

We will now present a comparison between Mantua and Bamberg, two cities that are both linked to water, and that reached their apogee in the late Middle Ages and during the Renaissance.

Speaking of Mantua⁸⁴, this city is an extraordinary example of historical transformation, based on its Etruscan-Roman origins and then modified during the Middle Ages. The story of its foundation and the close link the city has with water is told even by the illustrious citizen Virgil, as Dante Alighieri wrote in his masterpiece (the *Divine Comedy*) in the early 14th century.

*Tosto che l'acqua a correr mette co,
non più Benaco, ma Mencio si chiama
fino a Governol, dove cade in Po.*

*Non molto ha corso, ch'el trova lama
ne la qual si distende e la impaluda:
e suol di state talor esser grama.*

(Inferno XX, 76-81)

⁸³ Except for the last one: the Royal Palace of Caserta (from mid-18th century to mid-19th century).

⁸⁴ Mantua and Sabbioneta were chosen according to criteria 2 and 3 of the Operational Guidelines.

This city was always linked to water⁸⁵ having three rivers nearby (Mincio, Oglio and Po). Nonetheless, this bond increased during the municipal-medieval period when the hydraulic planning of Alberto Pitentino (1187) fragmented the course of the Mincio into four lakes: Superiore, di Mezzo, Inferiore, and Paiolo (the latter dried up in the 18th century). Later, in 1328, the Gonzaga took power and maintained it until the beginning of the 18th century. During their reign, and especially between the 15th and 16th centuries, Mantua reached its apogee. Extraordinary hydrogeological engineering works, especially for textile production, were carried out, and the House of Gonzaga commissioned urban, artistic, and architectural wonders to geniuses such as Mantegna, Alberti and Romano. It is sufficient to mention Palazzo Ducale, Palazzo Tè (so-called not for the drink but because it stands on an island formerly called Tejeto), and the Castle of San Giorgio. As if this was not enough, the experience of Sabbioneta as an ideal city built in the second half of the 16th century must be added to the list, as a European example of beauty and harmony. Thanks to its rich history, Mantua and Sabbioneta became officially part of the UNESCO heritage in July 2008, as well as being awarded the title of Italian Capital of Culture for the year 2016 (Commissione Nazionale Italiana per l'UNESCO, 2021).

Speaking of Bamberg⁸⁶, instead, its history as a city officially began around the 9th century (although its area had previously been populated by the Slavs), soon establishing political and religious control in Franconia. Thus, it began a long period of prosperity, with the construction of the Benedictine abbey of Michaelsberg (1004) first and then the cathedral (13th century), which houses the famous sculpture of the Knight of Bamberg (1230) (*Patrimoni UNESCO in Germania*, 2020). The area of the city declared Cultural Heritage of Humanity in 1993 includes three ancient settlements: the hilly city with its impressive architectural forms, owned by the clergy; the island city within the Regnitz river, a middle-class area devoted to trading and crafts; and the city of gardens, faithful to the traditions of gardeners. The second area is the one most linked to water. According to the legend, the bishop of Bamberg refused to give even just a millimeter of his property to the citizens to build a town hall. The citizens, then, worked hard to insert poles in the bed of the Regnitz, thus creating an artificial island in the middle of the river where the first town hall was built and remains today. Moreover, there is an ancient settlement of fishermen along the left arm of the Regnitz river, nicknamed “Little Venice” as dense half-timbered buildings and small

⁸⁵ To further explore the topic, we recommend the book *Mantova e l'acqua, amore antico* by Parmigiani (2019).

⁸⁶ Bamberg was chosen according to criteria 2 and 4 of the OG. Link to the official website: <https://www.bamberg.info/>

gardens define the image of this neighborhood. Finally, great attention is also given to contemporary art, where the new joins the old, often in the middle of nature. For example, along the meadows of the river Main, it is possible to admire sandstone sculptures over one-meter-high depicting the “faces of the river”. Even the surrounding areas show their strong link with water. One of the nearest towns is called Schweinfurt, which means pig's ford, and shortly afterward stands Bad Kissingen⁸⁷. This last town is one of the sites that is still waiting to be nominated by UNESCO as World Heritage (UNESCO WHC, n.d.a.), being part of the so-called “Great Spas of Europe”. This application, signed in 2014, concerns seven European countries and sixteen spas such as the previously mentioned Bad Kissingen in Bavaria, near Bamberg, and Montecatini Terme in Tuscany, near Florence.

6.2 - Villa d'Este in Tivoli and the Bergpark Wilhelmshöhe in Kassel

The sixth comparison will focus on two realities that use water to achieve a playful and aesthetic purpose, creating that “locus amoenus” so dear to the ancients. These two places are Villa d'Este in Tivoli and Bergpark Wilhelmshöhe in Kassel.

As for the Italian case, this “villa” is one of the most notable examples⁸⁸ of the refined Renaissance culture, inscribed by UNESCO on the World Heritage List in 2001. Thanks to its innovative design and the creativity of the architectural components of the gardens, such as the fountains and ornamental pools, it shows itself as a natural unicum immersed in water, as well as being an Italian garden of the sixteenth century, inspiring subsequent developments in Europe. The entire complex was designed by Pirro Ligorio (1500-1583) on behalf of Cardinal Ippolito II d'Este of Ferrara (1509-1572), who, after being appointed governor of Tivoli in 1550, wanted the construction of a building suitable for his new status. The whole forms an irregular quadrilateral and covers an area of about 4.5 hectares. Since 1560, great efforts were made specially to supply the water needed for the numerous fountains embellishing the gardens. Once the water supply was ensured (and its outflow made possible by the natural gravity created by the different levels of the garden), the works for the construction of the fountains, ornamental basins, and caves began, as well as for the arrangement of the landscape. The most surprising effect is produced by the large waterfall that flows from a crater perched in the center of the exedra. Jets of water were activated whenever people walked under the arcades. In particular, the “Bicchierone

⁸⁷ Bad Kissingen is a famous Franconian spa town, always frequented by illustrious personalities.

⁸⁸ Villa d'Este in Tivoli was chosen according to criteria 1, 2, 3, 4 and 6 of the OG. Link to the official website: <https://whc.unesco.org/en/list/1025/>

Fountain” was added to the decoration of the central longitudinal axis in the seventeenth century, based on a design by Bernini (1660-61). This fountain has the shape of a serrated chalice, from which a high jet of water falls into a shell. The garden with its fountains is a masterpiece of hydraulic engineering, both for the general layout of the plant and the complex water distribution system, as well as for the many water games thanks to the introduction of the first hydraulic automatons ever built.

In the same city (Tivoli) there are two other cultural works of considerable value and rich in water, which it is necessary to mention even if they are not from the Renaissance. The first is the Villa Adriana⁸⁹ which has been part of the UNESCO heritage since 1999. It is an exceptional residence of the Roman emperor Hadrian, built between 117 and 138 BC. The villa was conceived as an ideal city, taking up the architecture and environments of ancient Greece, Rome, and Egypt thanks to beautiful residential and recreational buildings, large gardens, and reflecting pools. The second one is the Villa Gregoriana Park⁹⁰, which has not yet been inscribed on the UNESCO World Heritage List⁹¹ but is part of the Italian Environment Fund. In 1832, Pope Gregory XVI promoted a grandiose work of hydraulic engineering to contain the continuous floods of the Aniene, channeling its waters into a double tunnel dug in Mount Catillo and then artificially swelling them, giving life to the 120 meters jump of the new Great Waterfall, second in Italy after the Marmore Falls. Once these works were completed, the Pope created the park that bears his name and which was, for over a century, the destination of artists, writers, and men of culture who spoke about its beauty. Other villas of the papal nobility in Lazio that have been on the UNESCO tentative list (UNESCO WHC, n.d.a.) since 2006, such as “Villa Lante” in Bagnaia and the “Giardino di Bomarzo” near Viterbo, would be interesting to present but for reasons of space, they will not be considered in this paper.

As for the German case, Wilhelmshöhe’s monumental water features and the gigantic statue of Hercules⁹² are combined in an extraordinary demonstration of man’s dominion over nature in Kassel⁹³, among the Fulda river, in the Hessian Lander. The surface of the park, which extends over 2.4 square kilometers, makes it the largest European hilly park and one of the largest landscape parks internationally. The spectacular use of water can be seen as it

⁸⁹ Villa Adriana was chosen according to criteria 1, 2, and 3 of the OG. Link to the official website: <https://whc.unesco.org/en/list/907/>

⁹⁰ Link to the official website: <https://www.fondoambiente.it/luoghi/parco-villa-gregoriana>

⁹¹ This area is on the tentative list since 2006.

⁹² Bergpark Wilhelmshöhe was chosen according to criteria 3 and 4 of the OG. Link to the official website: <https://whc.unesco.org/en/list/1413/>

⁹³ In the 19th century, the Brothers Grimm lived here and wrote their fairy tales.

flows from the Octagon, crowned by the statue of Hercules, through the Vexing Cave and the Artichoke Basin with their hydro-pneumatic acoustic effects, then passing through the Felsensturz Waterfall and the Giant's Head Basin along the Baroque waterfall to the Neptune Basin. Here the main attraction can be found, that is "The Grand Fountain", a geyser 50 meters high which was the highest in the world at the time it was built in 1767. Looking at its history, the works were started by the Landgrave Charles of Hesse-Kassel around 1689 in an east-west axis ending in the city center of Kassel and were further developed in the 19th century. Tanks and canals behind the Hercules Monument supply water to a complex system of hydropneumatic devices powering the large Baroque water theater, the caves, and the fountains such as the 350-meter-long Great Waterfall. In addition to all this, canals and streams meander along the axis, feeding the waterfalls, lake, and secluded ponds that animate the romantic garden created in the 18th century by Carl's great-nephew, Elector Wilhelm I. For its characteristics, it has many similarities with the Garden of Valsanzibio on the Euganean Hills, as it was built in the same period, with the baroque style of the late 17th century.

6.3 - The botanical garden of Padua and the Dessau-Wörlitz Garden Realm

The seventh comparison is linked to two natural places that have played an active role in both the educational and aesthetic field. They are the botanical gardens of Padua⁹⁴ in Veneto and the Dessau-Wörlitz Garden Realm in Saxony-Anhalt.

As for the Italian case, Padua possesses the first university botanical garden in the world, created in 1545, which makes it the oldest surviving example of this type of cultural site. This place is the archetype of botanical gardens in Europe, representing the birth of botanical science, scientific exchanges, and the understanding of the relationship between nature and culture. For this reason, UNESCO has inscribed it on the World Heritage List since 1997⁹⁵. The botanical garden preserves its original layout, a central circular plot that symbolizes the world surrounded by a ring of water representing the ocean. The plan is a perfect circle with a large square inscribed, divided into four units by orthogonal paths, oriented according to the main cardinal directions (embracing the idea of the "hortus conclusus" from the monasteries). This site is exceptional for its high scientific value in

⁹⁴ In July 2021, Padua could obtain a second UNESCO site for the pictorial cycles of the 14th century.

⁹⁵ The Botanic Garden of Padua was chosen according to criteria 2 and 3 of the OG. Link to the official website: <https://whc.unesco.org/en/list/824/>

terms of experimentation, teaching, and collection, and for its layout and architecture. Its herbarium and library continue to be among the most important in the world. Besides all this, a new construction called “Garden of Biodiversity” was inaugurated in 2014. It looks like a closed place that simulates the climatic conditions of the Earth’s biomes, adjusting humidity, water, and temperature for the plants inside. The building, with a very low environmental impact, consists of a glass place 100 meters long and 18 high, whose shape is optimized to enlarge the solar energy supply. The natural precipitations feed a collection tank of 450 cubic meters, while the waterfalls placed on the main facade ensure the movement and correct oxygenation of the water reserve. In addition to the rainfall, the water for greenhouse operations is drawn from an artesian well 284 meters deep from which water at a temperature of 24° C is taken, to allow tropical plants to live all year round. It is also used to supplement the water reserve in case of drought or lack of rainfall. The energy obtained from the photovoltaic panels guarantees the operation of the pumps and related sensors that regulate the water cycle (Orto Botanico Università di Padova, n.d.).

As for Germany, the Dessau-Wörlitz Garden Realm is an outstanding example of landscape design and planning from the Enlightenment age in the 18th century, designated by UNESCO⁹⁶ as World Heritage site in 2000. The magnificent buildings, river parks, and the English style landscape garden primarily served aesthetic and educational purposes. For Prince Leopold III Friedrich Franz of Anhalt-Dessau (1740-1817) and his friend and adviser Friedrich Wilhelm von Erdmannsdorff (1736-1800), the study of gardens in England and ancient buildings in Italy during several trips was the starting point for their own creative program in the small principality on the Elbe and Mulde rivers. As a result, the first landscape garden in continental Europe was created here, around Wörlitz. Among the new and characteristic components of this landscape garden there was the integration of an educational element, deriving from the philosophy of Jean-Jacques Rousseau (1712-1778), the thought of Johann Joachim Winckelmann (1717-1768), and the aesthetics of Johann Georg Sulzer (1720-1779). The notion of public access to buildings and land reflected the pedagogical concept of the humanization of society. Through the deliberate demonstration of new cultivation methods in the landscape garden, the developments in Anhalt-Dessau were not just theoretical, but a practical demonstration of their models. Another feature of the landscape is the integration of new technological achievements, such as the construction of bridges, an expression of the continuous search for modernity. Through the conscious incorporation of the old tracks of Oranienbaum and Mosigkau into a

⁹⁶ The Garden Kingdom of Dessau-Wörlitz was chosen according to criteria 2 and 4 of the OG. Link to the official website: <https://whc.unesco.org/en/list/534/>

pantheon of styles, the landscape has become an architectural encyclopedia with examples from antiquity to the latest developments. Nowhere else in Germany or Europe had an enlightened prince put in place such a broad and comprehensive program of landscape reform, particularly one that is so deeply rooted in philosophical and educational theory.

6.4 - Ferrara with the Po delta and the Muskauer park on the Lusatian Neisse

The eighth comparison we will present concerns two realities that have contributed to the development of modern architecture: Ferrara with the nearby Po delta in Emilia-Romagna, and the Muskauer park among the Lusatian Neisse on the border between Saxony and Poland. These places were not created for educational purposes as much as in the previous case, but for practical purposes to manage the territory. Such territory was indeed strongly connected to the aquatic world in both contexts, requiring a complex system to be developed. Nonetheless, the area was so well managed that the solutions implemented have been later resumed on a large scale in both Europe and the United States.

As for the Italian case, Ferrara⁹⁷ grew up around a ford not far from the ancient and vast Delta of the Po River. This allowed the city to count on medieval agricultural development at first, until it became an intellectual and artistic center attracting the greatest minds of the Italian Renaissance in the 15th and 16th centuries thanks to the Este dynasty. The humanist concept of “ideal city” came to life here in the neighborhoods built starting from 1492 by Biagio Rossetti according to the new principles of perspective, as highlighted by the famous “Addizione Erculea”. The completion of this project marked the birth of modern urbanism and influenced its subsequent development. The interventions were not limited to the city center exclusively but also to the countryside and the river. From the 14th to the 16th century the Este family carried out extensive reclamation interventions. Examples are the drainage of vast swampy areas, the establishment of “castalderie” (estates), the creation of new waterways and roads as part of the overall urban development plan, and the birth of a network of noble residences known as the Este Delights. The intervention was so profound that the original shape of the Renaissance landscape of the Po river delta is still recognizable in the 21st century structure of the region. This is the reason why UNESCO designated this area as World Heritage site in 1995. A final aspect that emphasizes the

⁹⁷ Ferrara and the Po delta were chosen according to criteria 2, 3, 4, 5, and 6 of the OG. Link to the official website: <https://whc.unesco.org/en/list/733/>

environmental and urban link between Ferrara and water can be found in the name of the city's tourist portal called "Ferrara Terra e acqua"⁹⁸.

As for the German case, the Muskauer Park⁹⁹ (Mużakowski Park in Polish) appears as a vast landscape developed between 1815 and 1844 by Prince Hermann von Pückler-Muskau on his estate and then continued by his pupil Petzold. Harmoniously situated in the Lusatian Neisse River Valley, the park's integration into the local town, surrounding agricultural and aquatic landscapes, has promoted landscape design and contributed to the advancement of landscape architecture as a discipline. The extensive site includes the Neisse River, other water features both man-made and natural, bridges, buildings, wooded areas, and trails.



Figure 12 - Rakotzbrücke, the mythical "Devil's Bridge"
Source: berlinomagazine.com - Year: 2017

The Muskauer Park is an example of cultural landscape where man has made the most of the natural features of the site. The park is of the highest aesthetic quality and its composition blends smoothly with the naturally formed river valley. Its essence is the visual relationship between the central residence, the New Castle, and a series of topographical focal points including ideal observation points arranged along the riverside terraces that flank the valley, each of which is part of a masterful network of panoramas. The property includes the central part of this vast landscape composition which measures 348 hectares (136.10 in Germany and 211.9 in Poland). The incorporation of the community into the overall composition, as a key component in its utopian landscape, as planned, has had a major impact on contemporary urbanism, particularly in the United States (as illustrated by the green areas of the city of Boston, Minneapolis, and Philadelphia) and on the development of the profession of landscape architecturer. Pückler published the principles of his landscape design theory in a book called *Andeutungen über*

⁹⁸ Link to the official website: <https://www.ferraraterraacqua.it/it/home-page>

⁹⁹ The Muskauer Park was chosen according to criteria 1 and 4 of the OG. Link to the official website: <https://whc.unesco.org/en/list/1127/>

*Landschaftsgärtnerei*¹⁰⁰ (1834). This training tradition has been revived in recent times by the creation of the Muskauer School, an international school for garden training and maintenance of cultural landscape. All these reasons explain why UNESCO decided to inscribe the Muskauer Park on the World Heritage List in 2004.

6.5 - The royal palace of Caserta and the palaces of Potsdam and Berlin

The ninth comparison we will illustrate between an Italian and a German UNESCO site with a strong link to water concerns some royal palaces from the 18th century based on the Versailles and Escorial models. These are the Royal Palace of Caserta in Campania and the Palaces of Berlin and Potsdam in the “länder” of the capital.

As for the Italian case, the extraordinary monumental complex of Caserta¹⁰¹ (located in the north of Naples) was designed in the second half of the eighteenth century by the famous architect Luigi Vanvitelli (1752), following Charles of Bourbon’s desire to rival the palaces of the time. The property includes a sumptuous palace with about 1200 rooms, a park, some gardens and wooded areas, as well as the Carolino Aqueduct and the San Leucio industrial complex, built for silk production. The Royal Palace is the fulcrum of the entire architectural composition and is located on a central axis that divides the forest in the back from the royal park in the front. On an area of about 11 acres, the pools, fountains, and waterfalls of the garden are aligned creating a “telescope effect” to form a real “waterway” following the slope of the hill and alternating overlapping water basins and statues. The first fountain is called “Dolphins” because the water comes out of the mouths of three large fish carved in stone. The fountain of “Aeolus” follows, with its large exedra where there are many “caves” that simulate the abode of the winds, represented by numerous statues of “Zefiri”. There are also seven sloping pools forming as many waterfalls, and the fountain of “Cerere”, a symbol of the fertility of Sicily, with the statues of the goddess and the two rivers of the island. The last fountain summarizes the story of “Venus and Adonis”. In the basin below the Monte Briano waterfall, known as “Diana’s bath”, two important marble groups depict Atteone at the moment when, after being transformed into a deer, he is about to be torn to pieces by his own dogs, and Diana, surrounded by nymphs, surprises him as he

¹⁰⁰ “Andeutungen über Landschaftsgärtnerei” means “Hints about Landscape”.

¹⁰¹ The Royal Palace of Caserta was chosen according to criteria 1, 2, 3, and 4 of the OG. Link to the official websites: <http://musei.beniculturali.it/musei?mid=801&nome=parco-della-reggia-di-caserta>; <https://whc.unesco.org/en/list/549/>

comes out from the bathroom. Not far from here, there is the Caroline aqueduct (1762), which directs waters from the slopes of Mount Taburno to feed the fountains of the royal gardens and irrigate the plants. It is also worth mentioning its imposing viaduct called “Ponti della Valle”, an incredible piece of engineering that proves the functionality of the infrastructure not only for the palace and the gardens but also for the mills, ironworks, and industrial factories located along its route. Thanks to all these beautiful elements, the royal palace of Caserta was inscribed on the UNESCO World Heritage List in 1997.

As for the German case, the palaces and parks of Potsdam and Berlin¹⁰² represent an autonomous ensemble of landscape architecture and gardening from the 18th and 19th centuries. With 500 hectares of parks and 150 buildings built between 1730 and 1916, these places form an artistic ensemble, whose eclectic nature reinforces its sense of uniqueness in a beautiful region of rivers, lakes, and hills. The region extends to the Berlin-Zehlendorf district, with palaces and parks lining the banks of the Havel river and Lake Glienicke. Also called under the epithet of “Prussian Arcadia”, the areas most linked to water are certainly the Sanssouci Palace and Park, the New Garden, and Babelsberg Castle¹⁰³, very well described on the “Stiftung Preußische Schlösser und Gärten Berlin-Brandenburg” website and included in the UNESCO list in 1990.

The Sanssouci Palace was erected during the reign of Frederick II of Prussia between 1745 and 1747 as a personal summer residence in the Rococo style. Unlike the Royal Palace of Caserta, this building was not intended for the court and the exercise of government functions, it rather served as a private shelter for the king and his most intimate guests (such as Voltaire). This palace was quite modest in size compared to the competition, originally having twelve rooms, of which five only were inhabited by the sovereign. This proves the use of the place, not intended for the display of magnificence but rather for rest purposes. Nevertheless, the palace recovers many elements typical of the most famous royal palaces such as the perspective view, plenty of fountains and water jokes, and vast grassy areas. Many of the original species have survived to this day. Together with native plants, the meadows constitute the characteristic charm of this park. This magnificent diversity can be preserved only because the meadows can develop undisturbed and free

¹⁰² The Palaces-Parks of Potsdam-Berlin were chosen according to criteria 1, 2, and 4 of the OG. Link to the official website: <https://whc.unesco.org/en/list/532/>

¹⁰³ In addition to the three places mentioned above, others deserve consideration such as the Marble Palace and Cecilienhof Palace in Potsdam (where the famous Potsdam Conference of 1945 took place), and all included buildings of Berlin such as the Glienicke Castle and Park (Berlin), the Pfaueninsel (this is also a nature reserve), the Böttcherberg and the Glienicke Hunting Palace (Berlin).

from economic interests. Waterways and lakes are particularly evocative, with numerous aquatic birds, amphibians and rare insects having settled on the banks. The banks are also lined with aquatic and foliar plants that are worth protecting.

The New Garden was created in the area between the Heiligensee, the Jungfernsee, and the Pfingstberg in 1787, with its exotic architecture including its pyramid, its gothic library, and its surprising cave. There is an abundance of different ecological niches and shelters for species that have become rare elsewhere or even threatened with extinction. From the magnificent old trees, passing through the biotopes from dry meadows to the different reed communities on the banks of the two great lakes.

The Babelsberg Castle is picturesquely located on the banks of the Havel. Its richly decorated terraced gardens enliven the scene around the neo-gothic palace. The Babelsberg Castle is also characterized by a finely modeled area with flower gardens and water features, going towards the park with its ancient trees and fascinating views of the surroundings. The park has a very high ecological value. Its ongoing maintenance provides an ideal habitat for endangered plant and animal species. This is where birds find their nesting and resting places. The edges of the water also have a high ecological value as numerous animals such as birds, amphibious insects, and beavers live in the reed belt¹⁰⁴.

¹⁰⁴ For further information: <https://www.spsg.de/schloesser-gaerten/unesco-welterbe/>

Chapter 7 - The case study of Venice: the Adriatic Queen

The nine comparisons above witness the importance of water in these spectacular places surrounded by nature, showing their rich history and architecture. Therefore, what has already been said appears to be enough to emphasize how much the presence of this element has contributed to the development of places, cities, and landscapes worthy of being protected and enhanced globally. The next two chapters, however, will try to further expand the discussion by showing aspects not yet covered that must be considered, especially from a management point of view. The focus will be on two other UNESCO sites that have an even closer connection with water in their past, present, and future: Venice and Augsburg.

The first UNESCO site we will present is the city of Venice in Italy, also known as the queen of the Adriatic. Many things can be said about the combination of this place with water, in particular with the sea, and a masterful thesis would not be enough to worthily illustrate this link. For this reason, the present chapter will especially focus on information and documents contained in the official UNESCO website of “Venice and its lagoon”¹⁰⁵. This site was inscribed on the World Heritage List in December 1987 for its uniqueness and its cultural values, consisting of an exceptional cultural, historical, archaeological, urban, architectural, artistic heritage, stratified over the centuries and integrated into an extraordinary natural landscape. This site can be considered as a “cultural landscape”, showing the combination of human and natural work overtime, under the influence of many physical, social, economic, and cultural constraints. This environment is particularly fragile, and more than other UNESCO sites it requires an adequate and updated management plan. Looking at regulatory, it was only in 2005 that the World Heritage Committee asked all sites to have a management plan for UNESCO sites. For what concerns Italy, this request was fulfilled by MiBACT¹⁰⁶ the following year. As for Venice, from 2006 onwards many agreements and investments have been implemented, culminating in the approval of the management plan for the period 2012-2018 (City of Venice - Office of the World Heritage Site, n.d.), which is periodically updated. There are still some shortcomings, however, (as the absence of an adequate “buffer zone”), probably due to the recent birth of the plan. We will further illustrate this aspect later.

¹⁰⁵ Link to the official website: <http://www.veniceandlagoon.net/web/>

¹⁰⁶ Reference is made to the law 77/2006: “Misure speciali di tutela e fruizione dei siti italiani di interesse culturale, paesaggistico e ambientale, inseriti nella Lista del Patrimonio Mondiale, posti sotto la tutela dell’UNESCO”, modified then with the law 112/2013 and 44/2017.



Figure 13 – View of Murano and the Alps
Source: Veniceandlagoon.net (photo by F. Vianello) - Year: 2021

This management plan deserves to be further analyzed in order to show its full potential¹⁰⁷. To understand why, it is useful to start from the analysis of the problems that the place presents. Considering the state of advancement of the high-water defense systems, the main emergencies affecting the lagoon and the historical settlements of Venice are the following: wave motion from wind and water traffic; the destruction of the seabed due to illegal fishing in the lagoon; pollution; the problems of conservation of building heritage due to the progressive loss of resident population in the historic center and the islands of the lagoon; and the growing pressure caused by tourism. Regarding especially the last two aspects, the Coronavirus pandemic has emphasized the difficulties for the city due to its mono-economic structure based on tourism, together with its lack of residents. For each one of the macro-emergencies¹⁰⁸ previously mentioned, some shared guidelines were set which the persons responsible for the UNESCO site must comply with when planning their territory and implementing better interventions. Thanks to the thematic consultation tables, the SWOT evaluation, the insights into the macro-emergencies of the site, and the discussions between the bodies responsible for the protection and management of the place in the Steering Committee, the management plan was able to set out twelve strategic objectives at page 80 of the official document to be achieved through the following action plans:

¹⁰⁷ All incoming information is contained in the public document *Venice and its lagoon. The Management Plan 2012-2018* (City of Venice - Office of the World Heritage Site, n.d.).

¹⁰⁸ Here is the complete list of the macro-emergencies: 1) hydraulic/high water risk; 2) wavy way; 3) pollution; 4) depopulation; 5) tourist pressure; 6) great works; 7) illegal fishing; 8) urban and building decay.

1. Protect, recover and enhance human settlements (such as urban fabrics and rural architecture), the environment and the lagoon landscape;
2. Protect, recover and enhance the architectural, archaeological, historical, artistic, ethno-anthropological, archival, and book heritage of the area;
3. Rebuild the socio-economic fabric of historic centers and increase residents;
4. Rationalize tourist flows by developing complementary forms of traditional tourism (such as sustainable tourism structures in the minor Venice and the lagoon);
5. Preserve and support productive occupational activities, traditional productions and promote new activities compatible with the characteristics of the site;
6. Improve accessibility and mobility with a better transport system within the site, especially promoting slow alternative forms of mobility in the territory;
7. Develop urban and peri-urban agriculture with many orchards, to protect productive agricultural areas, avoid depopulation and promote the rural tourism;
8. Strengthen the awareness of the universal values of the site, promoting many active forms of dialogue, participation, and involvement of the actors;
9. Coordinate and promote cultural-territorial marketing initiatives referred to the site;
10. Enhance human capital and resources by strengthening and integrating training and research systems for environmental and cultural heritage;
11. Create a coordination system to share and disseminate research, surveys, and data produced by institutional bodies, and to identify new topics to be developed;
12. Promote joint and standardized services offered to citizens by the organizations present in the area for the use of cultural heritage on the web.

Once the problems and strategic objectives to be achieved had been identified, the action plans were developed, starting from the methodology and concluding with the definition of the plans and projects. The dialogue between institutional organizations and the incredible variety of stakeholders was the basis for the birth and development of a shared vision of the site management. According to the website and the documents available, the entire process involved the call of about 250 public and private bodies with 136 formulated proposals in just 3 months. The issues addressed are attributable to the following five categories: 1) regional planning and governance; 2) protection and conservation of the heritage; 3) sustainable use of the site; 4) communication, promotion, and training; 5) knowledge and sharing. Four action plans were developed from these five¹⁰⁹ categories to achieve the

¹⁰⁹ The first category could be seen as a summary of the other four, that is why it is not further developed.

twelve¹¹⁰ strategic objectives, as illustrated at page 91 of the management plan. On this basis, concrete projects were created, divided before into two major categories and then according to the four action plans. The first category regards the system projects which concern intervention affecting the management of the entire system of the site, with the involvement of several competent actors. This first category includes the following ideas:

- the definition of a “buffer zone”¹¹¹; the maintenance and enhancement of the historical connection networks between Venice and the hinterland (through the waterways); the legal constraints and management plan of the Submerged Lagoon Sites (plan 1.1);
- the study and systematic interventions of the slow mobility network of access to the site and the navigable nearby rivers; diversified proposals for visits implying the use of the area in its complexity including the gardens and peri-urban areas (plan 1.2);
- a communication project of the cultural and environmental values of the site with the creation of a related strategic agenda; the use of a UNESCO quality label or brand; the study of the synergies between the territory and the maritime traffic¹¹² (plan 1.3);
- further development of the projects already carried out such as VELARIA¹¹³ for the information network of archives related to the site, SIPLAN¹¹⁴ for the data interoperability on urban and territorial planning of the site, SUSTCULT¹¹⁵ for the “SUSTainability management of CULTural heritage” in Europe (plan 1.4).

The second category regards specific projects proposed by individual bodies and institutions about their territories, and the assets to be protected and enhanced. Many ideas have been elaborated for this second category as well, divided according to the four action plans:

¹¹⁰ The protection-conservation of the heritage deals with objectives one and two; the sustainable use of the site with objectives three, four, five, six, and seven; the communication, promotion, and training with objectives eight, nine, and ten, while knowledge and sharing are related to objectives eleven and twelve.

¹¹¹ A “buffer zone” is a sort of filter to the external pressures that should embrace the territory that conditions the existence of the place itself, contributing to the maintenance of the landscape, preserving the views, and building a logistical support area for the related activities of the site.

¹¹² An example worth mentioning is the “Life Lagoon Refresh” project to restore the saline gradient, by introducing fresh water from the Sile river to the Venice lagoon and therefore improving the environment and biodiversity. Link to the website: <http://www.lifelagoonrefresh.eu/>

¹¹³ Link to the official website:

http://www.veniceandlagoon.net/web/en/ongoing_projects/management_plan_projects/velaria/

¹¹⁴ Link to the official website:

http://www.veniceandlagoon.net/web/en/ongoing_projects/management_plan_projects/siplan/

¹¹⁵ Link to the official website:

http://www.veniceandlagoon.net/web/en/ongoing_projects/european_projects/sustcult/

- the evaluation of the decay of the site due to mass tourism; the project for the enhancement of the lagoon waterfront (Fusina access gate); the protection of the rural architecture of the “Taglio del Sile”; the growth of Forte Marghera, and North Lagoon projects; the development of the archaeological areas (plan 2.1);
- the construction of a rocker bridge over the “Piave Vecchia” and cycle paths (such as Conca di Portegrandi-Caposile and Siloncello embankment); the recovery of lagoon landscapes and culture with the redevelopment of some smaller islands and ad hoc guided tours (Casse di Colmata, lagoon huts, Torcello-Altino itineraries) (plan 2.2);
- the development of a coordinated image of the Brenta villas and a guide to the Venetian hinterland; the promotion of the series “Alle foci del Medoacus Minor”; the creation of some cards (as for Chioggia), days and festivals on water (plan 2.3);
- the digital reproduction of descriptive, cartographic, and geometric-particle sources, with the creation of databases for diachronic knowledge of the area “Venice and its Lagoon”; creation of QR codes, and virtual maps in the Altino territory (plan 2.4).

A final important aspect is the constant monitoring to ensure the success and maintenance of these projects. Three indicators are used for this and are related to status, pressure, and result. The first two deal only with the macro-emergencies while the last one with the action plans. The ability to control and implement this management plan is mainly coordinated by a “steering committee”, formed by a representative of each body responsible for the site or each body having direct competencies on the protection and management of the site. Here the Municipality of Venice is considered as the referent for all the stakeholders involved, firstly according to law 77/2006 and secondly with a memorandum of understanding in July 2007. Nine municipalities are involved¹¹⁶, the Veneto region, the province of Padua, the metropolitan city of Venice, the MiBAC regional secretariat for Veneto, the superintendency for archeology, fine arts and landscape for the municipality of Venice and the Lagoon, the archival superintendency for Veneto, the museum center of Veneto, the State Archives of Venice, the diocese of Venice, the port system authority of the Northern Adriatic Sea, and the interregional superintendency of Veneto, Trentino Alto Adige and Friuli Venezia Giulia¹¹⁷.

On the UNESCO website of Venice and its Lagoon, six itineraries are also recommended. The first circuit is related to cycle tourism and is divided into two routes. One is the “Piave

¹¹⁶ The municipalities are: Campagna Lupia, Cavallino Treporti, Chioggia, Codevigo, Jesolo, Mira, Musile di Piave, Quarto d’Altino, and Venice.

¹¹⁷ For more information: http://www.veniceandlagoon.net/web/comitato_di_pilotaggio/

low BIM path”, which encompasses the Sandonatese area. It is developed as a series of inter-municipal cycle paths that form a link between the left and right banks of the Piave¹¹⁸ arriving then in Caposile, where the Piave and Sile rivers meet at the Taglio del Sile. The value of these territories is mainly touristic-naturalistic, given the high environmental quality of the area. The second route is the “Jesolo Green Route”, with a beautiful panoramic view surrounded by nature. From Drago square (in the Jesolo Lido city center) anyone can reach the Torre Caligo area, where a dirt road begins and gets lost in the Venice lagoon. Many animal and plant species can be observed up to Lio Maggiore. The route continues then along the bends and meanders of the Sile river. There are many different taverns among the pathway, excellent for tasting some local products and relaxing.

The second circuit is related to culture and offers three alternatives. The first one is the 10 km Chioggia itinerary, ideal either on foot or by bicycle, giving the possibility to visit the main monuments of the center of Chioggia, from the Vigo bridge, built-in Istrian stone in 1685, passing by the church of the Holy Trinity to the Cathedral of Santa Maria Assunta. Along this path, there are also some large open spaces and a wonderful view of the Lusenzo lagoon. The second option refers to the visit of the archaeological and ethnographic civic museum of the South Lagoon, housed in “San Francesco Fuori le Mura”, a 15th century convent building. The exhibition unfolds on three levels: the ground floor houses the finds from the Roman to the early medieval times; on the first floor it is possible to admire the medieval, Renaissance, and modern collections, while the second floor exhibits the navy and shipyards from the 18th century. The third alternative is the provincial museum of Torcello, located in the Northern Lagoon of Venice, which tells the long story of this island¹¹⁹. This museum, with its two exhibition sections, the Archaeological and the Medieval-Modern sections, presents evidence from Veneto, pre-Roman, Roman, Byzantine, and Early Middle Ages and crosses the glorious times of the Serenissima up to the 19th century.

The third circuit refers to school teaching through five paths. The first one – called “Venezia si difende” – explains in detail the fortified system of the Venice lagoon with a particular emphasis on the role of the arsenal. The second one – called “Costruiamo insieme

¹¹⁸ The area is between San Donà di Piave, Fossalta di Piave, Noventa di Piave, and Musile and crosses some river parks and the old tratturo of the ancient "restera dei burci".

¹¹⁹ Torcello was surely inhabited as early as the 1st century AD. It was a landing place for commercial exchange between the sea and the hinterland and thanks to the nearby city of Altino and the imperial road system – composed by the “via Annia” and “via Claudia” - it was connected with eastern and northern Europe. However, its heyday in the 10th century did not last long due to the growth of neighboring Venice, which had the control over the entire lagoon.

un Bragozzo” – provides a general overview of what used to be the typical Chioggia boat (the *bragozzo*) with its sails, nets, and hull and allows then to customize a miniature wooden model of this boat. The third one – called “Il sale di Chioggia” – intends to illustrate one of the most important ancient trades of Chioggia: salt and its production, focusing especially on three aspects: how it was produced, its commercial value and use. The fourth one – called “La città dei pesci” – leads to the discovery of the coastal underwater world at the Natural History Museum in Venice with the sight of fish, mollusks, and other water animals in the aquarium room, then proposing to the children the construction of a small aquarium at school. The fifth path – called “Vita in mare” – still in the same place as the previous path, presents the marine environments and organisms that populate the oceans passing through the museum rooms dedicated specifically to the large oceans and the abyssal areas¹²⁰.



*Figure 14 – 1st part of the poster
“Abyss: Exhibition of the 13th International Underwater Photography Contest”
Source: Msn.visitmuve.it (photo by P. Bausani) - Year: 2020*

The fourth circuit refers to food, considering two main contexts. The first one is linked to the traditional Venetian markets, a good alternative to learn more about the city as experienced by Venetians. The Rialto Market, after almost a thousand years of activity, is still the place for daily shopping for Venetians. It offers a wide variety of fresh fish, fruit, vegetables, spices, meats, cheeses, pieces of bread, pasta, and sweets distributed in attractive stalls. The Fair-Trade Market takes place weekly in the Santa Marta area in the Dorsoduro district. It is a direct sales market, where customers can find a wide variety of organic products typical of the local gastronomy, grown on the islands of the Venice lagoon

¹²⁰ Noteworthy are also some photographic contests at this museum, such as the one illustrated in figure 14 (International Underwater Photography Competition 2020; 16/10-08/11).

and in its immediate hinterland. Finally, the Organic Vegetable and Cosmetics Counter is an artisan market whose products are made by hand in Venetian prisons using mostly recycled raw materials. The second aspect characterizing the fourth circuit follows the idea of eco-sustainable travel, going out on a boat with fishermen, listening to their stories, and observing them closely as they arrange the nets and divide the freshly caught fish. This fishing tourism allows anyone to become a fisherman for a day. It is a unique experience to feel Venice and its lagoon like its citizens, getting to know professional fishing in the lagoon and tasting traditional recipes. The itinerary develops in the north part of the lagoon, between Burano, Torcello, and Punta Sabbioni.

The fifth circuit refers to nature with three routes. The first one is the “Valle Averte Nature Reserve and WWF Oasis”. This place has the typical animals and vegetations of the natural environment of the fishing valleys, which is visible with the help of binoculars. Along the way, the history of the Venetian lagoon is told from a naturalistic point of view, as well as the transformations it has undergone by man. The characteristics of a fishing valley and the importance of one of the largest lagoon wetlands in Europe is illustrated along this route. The second route is the “Giuseppe Olivi Museum of Adriatic Zoology” in Chioggia. It was inaugurated in 2011 in the 18th century Palazzo Grassi, allowing guests to closely observe many Adriatic marine organisms. Room after room, visitors are introduced to the various marine ecosystems, presenting the habits of the animals that populate the underwater world. The museum itinerary also focuses on delicate and controversial topics such as the relationship between man and the sea, and between tradition and innovation. The third route of the fifth circuit is the “Oasis of the Dunes of the Alberoni and Ca’ Roman”, located between the Lido of Venice and Pellestrina. It contains one of the largest and best-preserved dune systems on the Upper Adriatic coasts, with dunes up to ten meters high. In this space, unique species of flora and fauna find their habitats. Thanks to its relative isolation, it preserves one of the most important migratory routes in Italy and many species of birds (about 190)¹²¹.

The sixth circuit refers to history, including three trails. The first one is the path among the “Cavallino-Treporti Fortifications”. Here are numerous forts, batteries, telemetry towers, barracks, bunkers. Although these have been disused military sites for years, they have been recovered and enhanced as they constitute an important trace of the history and culture of the Venetian lagoon. These structures dating back to the Austrian period and the two

¹²¹ Due to its naturalistic values, the Dunes of the Alberoni and Ca’ Roman is a European Site of Community Importance (SCI) and a Special Protection Area (SPA).

great wars are today surrounded by cultivated gardens and used as a warehouse or sometimes converted into homes or tourist facilities. The second trail of the sixth circuit is the “National Archaeological Museum of Altino”, inaugurated in December 2014. This site is one of the most important in Cisalpine Roman times, considering its international archaeological significance. The complex consists of two restored rural buildings and three new buildings and it is by extension, number, and quality of the services offered, the first archaeological museum in Veneto, a real cultural hub supporting the project of enhancement of Roman cities in Italy. The project was conceived to ensure the continuity of the exhibition narrative, developing differentiated paths and collateral activities. The historic site, which housed the museum for more than fifty years, has been refurbished and redeveloped as an additional exhibition space instead. The third path is the “Valle Millecampi” naturalistic oasis with its characteristic historic houses, in the municipality of Codevigo. The area is of high national and international public interest, due to its peculiar lagoon landscape, which is considered one of the most fascinating habitats for numerous species of birds, including rare ones. The “casoni” are a testimony to the rural tradition in symbiosis with the environment. Some of the remaining buildings are owned by the Province of Padua: the “Casone delle Sacche” and the “Casone Millecampi”. The newly built “casone della Boschettona” and “della Fogolana” are visible as well. All the structures are owned by the municipality and can be used for social purposes or visits.

We have now concluded the section related to the site of Venice and its lagoon. Another reality strongly linked to Venice, UNESCO, and water, which had already been introduced in Chapter 2 – section 2.2, deserves to be further analyzed. This is the Water Museum of Venice, a member of UNESCO’s Global Network of Water Museums since its birth in 1996, and from whose website¹²² this information is collected. The museum project aims to unify the most significant examples of the rich but fragmented heritage of the “liquid universe” within the “Tre Venezie” through an innovative online platform and a high number of digital itineraries to facilitate their localization and encourage physical visits to these places and sites. From elegant stately homes to imposing castles, from navigation basins to river ports and moorings, from natural oasis to parks, from water mills to museums: the heritage connected to the use of water, both natural and cultural, tangible and intangible, is the focus of this project. It is a challenge towards building a better future for everyone. It is addressed to any citizens and authorities who believe strongly in preserving the quality of all water, whether surface or underground, as well as the cultural and natural

¹²² Link to the official website: <https://www.watermuseumofvenice.com/>

related heritage. Therefore, the aim is to build a better world, contributing both directly through active interventions and indirectly through some education plans to the achievement of the Sustainable Development Goals of the 2030 Agenda.

The most relevant aspect is related to the varied and developed network that was created, made up of 64 partners. Nonetheless, the search for further private and public partners and sponsors is underway to complete the mapping for the territories of Venice, Vicenza, Treviso, Verona, Belluno, Ferrara, Trento, Pordenone, Udine, Trieste, and Gorizia. In the present paragraph we will deal with the associates already involved. They are divided into two main groups. The first group is called “The Padua Network” and can count on 34¹²³ diversified sites. There are many ancient castles and towers (like those of Monselice¹²⁴, Este¹²⁵, Catajo¹²⁶, Valbona, and Specola-Torlonga¹²⁷), unique museums (such as those of the River Navigation, River Archeology, and Roman Centuriation), river routes (like those of Padua, Limena, and around the Euganean Hills), natural reserves and oasis (such as those of Onara¹²⁸ and Ca’ di Mezzo), religious places (for example, the Benedictine Court of Correzzola and the Praglia Abbey¹²⁹), local canal villages (such as those of Pontemanco, Bovolenta, Battaglia Terme), Venetian villas (like the Contarini¹³⁰ one), beautiful gardens (such as those of Padua and Valsanzibio¹³¹) and healthy places (like the Thermal Spa in Montegrotto and Monteortone). Many of these sites are almost unknown, even for the locals, and have no websites. This water-based network represents therefore a great opportunity to spread sustainable tourism, while also helping to preserve the local identity.

¹²³ This is the full list: 1) Catajo Castle, 2) Museum of River Navigation, 3) Santa Margherita Water Pump Museum, 4) Padua River and Canal Circuit, 5) Portello river port, 6) Specola Tower, 7) Locks of Limena, 8) Prato della Valle Square, 9) Madonna della Salute Spring of Monteortone, 10) Onara Wetlands Nature Reserve, 11) Archaeological Museum of the Bacchiglione River, 12) Benedictine Court of Correzzola, 13) Ca’ di Mezzo natural Oasis, 14) Millecampi Valley, 15) Praglia Abbey, 16) Draganziolo flood plain, 17) Pontemanco canal village, 18) Valbona Castle, 19) Monselice Castle, 20) Medieval Canals of Euganean Hills, 21) Bovolenta canal village, 22) Battaglia Terme canal village, 23) Villa Contarini in Piazzola sul Brenta, 24) The Forest in Carmignano di Brenta, 25) The Isola Mantegna Basin, 26) Museum of Roman Centuriation, 27) Padua Botanic Garden, 28) Archaeological and Environmental Museum of Waterways in Padua, 29) Villa Barbarigo’s monumental garden of Valsanzibio, 30) The Procession of the Vow in Pontelongo, 31) Roman Thermal Spa in Montegrotto, 32) Vogalonga Euganea, 33) Remada a Seconda, and 34) Este Castle.

¹²⁴ Link to the official website: <http://www.castellodimonselice.it/>

¹²⁵ Link to the official website: <https://www.colleuganei.it/castelli/castello-carrarese-este/>

¹²⁶ Link to the official website: <https://www.castellodelcatajo.it/>

¹²⁷ Link to the official website: <http://www.latorlonga.it/museo-la-specola/>

¹²⁸ Link to the official website: <http://www.parcopaludeonara.it/>

¹²⁹ Link to the official website: <https://www.praglia.it/>

¹³⁰ Link to the official website: <http://www.villacontarini.eu/>

¹³¹ They were already cited previously in the text at points 4.1 and 6.3.

The second group is called “Po Delta Network” and can count on 30¹³² diversified sites. There are many unique museums (like those of Ca’ Vendramin Land Reclamation, Po Ocarina¹³³, Septem Maria, Bosgattia Republic, and Great Rivers), river routes (such as those of old water pumps, bridges of boats, and valley’s fishing), natural reserves and oasis (like those of Ca’ Pisani, Ca’ Zen¹³⁴, Ca’ Mello, Panarella¹³⁵, and Volta Grimana), religious places (for example, the Basilica of the Tomb in Adria and the Sanctuary of the Madonna del Pilastrello), local canal villages (like those of Loreo and Antiquarium, Santa Maria in Punta, Porto Levante, and Badia Polesine), and coastal protected areas (such as Scano Boa within the wider protected area of the Po Delta). Thanks to this variety of water places, many tours are offered in the areas of Padua and Rovigo. The main objective is to develop thematic educational paths of varying duration, involving several sites in a specific area. These visits are designed for people of any age but most of all for primary and secondary students to discover the diverse “aquatic worlds” behind their daily use, by looking at six key words¹³⁶ that simply explain the importance of water.

In conclusion, this chapter would not be complete without a deeper look into the future. Venice presents issues of various kinds, which are evident and sometimes reflect global future problems. A sustainable conversion is an obligatory choice, especially after the crisis triggered by Coronavirus. An ambitious goal for this city should be the European Green Capital Awards. It is the result of an initiative by 15 European cities (Tallinn, Helsinki, Riga, Vilnius, Berlin, Warsaw, Madrid, Ljubljana, Prague, Vienna, Kiel, Kotka, Dartford, Tartu, and Glasgow) together with the Association of Estonian Cities. Their green vision has been translated in 2006 into a joint memorandum of understanding, establishing an award to recognize and reward cities that are leading the way for environmentally friendly

¹³² This is the full list: 1) Golena Oasis of Ca’ Pisani, 2) Coastal Botanic Garden of Veneto, 3) Panarella flood plain, 4) River village of Loreo and Antiquarium, 5) Ca’ Vendramin Land Reclamation Museum, 6) San Basilio Museum and Romanesque church, 7) River village of Santa Maria in Punta, 8) Septem Maria Museum, 9) Tenuta Ca’ Zen in Taglio di Po, 10) Basilica of the Tomb in Adria, 11) Museum of Bosgattia Republic, 12) River village of Porto Levante, 13) Oasis of Ca’ Mello, 14) Adria and its riviera, 15) Ancient coastal dune barrier in the Delta, 16) Balutin Island, 17) Museum of the Great Rivers, 18) Po Ocarina Museum, 19) Scano Boa, 20) Ancient river village of Badia Polesine, 21) Abbey of Pomposa, 22) Sacca degli Scardovari, 23) Memories of the Po Delta, 24) Pathway of the old water pumps, 25) Volta Grimana Oasis, 26) Punta Maistra Lighthouse, 27) Gorgi di Trecenta, 28) Bridges of boats, 29) Sanctuary of the Madonna del Pilastrello, and 30) Valleys fishing’s Road.

¹³³ Link to the official website: <http://www.ocarinadelpo.it/>

¹³⁴ Link to the official website: <https://www.tenutacazen.it/>

¹³⁵ Link to the official website: https://www.wwf.it/oasi/veneto/golena_di_panarella/

¹³⁶ The six key words are: ancient - the hydrogeological cycle of a limited resource; rare - pollution and waste that threaten its quantity/quality; useful - daily uses between water rights and duties; pure - hygiene and SDG n.6 importance; mysterious - its anomalous properties according to science; and precious - an anthropological look at the "sacredness" of water for this planet.

urban life. Progress is already a reward, but the satisfaction of winning a prestigious European award pushes cities to further invest and raise awareness among citizens. Different cities can be inspired one from the other and share examples of good practice in situ¹³⁷. The overall message that this award system aims to convey locally is that Europeans have the right to live in healthy urban areas. Cities should therefore strive to improve the quality of life of their citizens and reduce their impact on the global environment. This message is summarised in the slogan of the Award: “Green cities - fit for life”. Since 2010, a European city¹³⁸ is selected each year as the European Green Capital of the Year. The prize is awarded to a city that:

- has a consistent record of achieving high environmental standards;
- is committed to pursuing ambitious objectives of further sustainable development;
- can serve as a model to inspire other cities and promote best practices in Europe.



*Figure 15 - European Green Capital Award
Source: Ec.europa.eu Site - Year: 2021*

This could be one potential objective for Venice in the medium term, but this city could aspire to even higher goals, considering the attention drawn by the Veneto Region to the topic. With the signing of the “Venezia Capitale Mondiale della Sostenibilità” resolution by President Luca Zaia in March 2021, a new synergistic project has come to life and will soon project Veneto into the future¹³⁹. There are many concrete organizations that could help with this project, starting from the Water Museum of Venice, but also others more

¹³⁷ Link to the website: <https://ec.europa.eu/environment/europeangreencapital/about-the-award/>

¹³⁸ Winning cities to date include Stockholm in 2010, Hamburg in 2011, Vitoria-Gastiez in 2012, Nantes in 2013, Copenhagen in 2014, Bristol in 2015, Ljubljana in 2016, Essen in 2017, Nijmegen in 2018, Oslo in 2019, Lisbon in 2020, and Lahti in 2021.

¹³⁹ Link to the official website: <https://www.regione.veneto.it/article-detail?articleId=11317181>

intangible bodies such as the new university course called “Environmental Humanities” at Ca’ Foscari University of Venice¹⁴⁰. A lot of work, however, still needs to be done.

The following chapter will present the German case study represented by the city of Augsburg, which can count on a long sustainable tradition and a strict bond with Venice. Indeed, these two cities have many similarities and have historically had a network of commercial, political, and artistic relationships, especially during the Middle Ages and the Renaissance. Even today there are still some important links. In this regard, the German Center for Venetian Studies¹⁴¹ must be briefly mentioned. It is an interdisciplinary scientific institution, which promotes scientific and artistic research on the history and culture of Venice and its surrounding territory. There is even an association¹⁴² that specifically supports and finances this center, whose president since 2007 has been Stefan Schrammel, who incredibly was born and works in Augsburg.

¹⁴⁰ Link to the official website: <https://www.unive.it/pag/38629/>

¹⁴¹ Link to the official website: <http://www.dszv.it/it/>

¹⁴² Link to the official website: <https://www.venedig-freunde-dszv.de/uber-uns.php>

Chapter 8 - The case study of Augsburg: the City of Water

After presenting an Italian case study, the attention will now shift to a second case study, which refers to the Bavarian city of Augsburg, next to Munich. The most valid source of information to explain the link of this city with water is the UNESCO website “The Water Management System of Augsburg”¹⁴³. Indeed, since July 2019 Augsburg has become a UNESCO World Heritage Site¹⁴⁴ thanks to its majestic and ancient fountains, its canals and numerous bridges (more than Venice), its ancient water towers (the oldest is the famous Rotes Tor), and its historical ingenious management of the water network. In the next paragraphs, we will analyze this site in detail, integrating the explanation with other historical, artistic, economic, and social references. As briefly introduced earlier, this city has a long sustainable tradition that finds its roots in the Roman origins, passing through the medieval and industrial development, up to the current days. In order to better understand its sustainability, it is therefore useful to analyze the history of this city¹⁴⁵.

Augsburg was founded in 15 BC as a permanent “castrum” by the victorious legions of Drusus and Tiberius¹⁴⁶ on the Vindelici. In 50 AC it was the capital of the province of Rezia and in 121 obtained the prestigious status of “imperial city” by Hadrian, with the name of Augusta Vindelicorum. It is recognized as the second oldest Roman city in Germany after Trier. Its location was particularly strategic, located between the banks of the Singold, Wertach and Lech rivers. Furthermore, given its proximity to the Danube-Rhenish limes, the city stood at the intersection of some important Roman communication routes such as the Via Claudia Augusta and Iulia Augusta. In 259 BC, it was besieged by the Alamanni and definitively occupied after 400. There is then a complete lack of documented evidence until 570. The re-foundation of the bishopric dates approximately to the year 630, while the presence of the first bishop is documented only around 750. In 955, bishop Ulrich defended the city from the Hungarians. During the investiture controversy and the war between the Guelphs and the Swabians, the city was besieged, conquered, and destroyed. Starting from 1251, with the affirmation of the bourgeoisie, the bishops gradually lost power over the city. In 1276, King Rudolf I granted the city the Stadtrechtsbuch (statute), while Emperor Ludwig IV elevated it to the rank of free city of the empire in 1316. Since then, bishops renounced all rights over it (Liebhart, 1991). Right from the thirteenth century, the city redeveloped by relying first on the richest families and

¹⁴³ Link to the official website: <https://wassersystem-augsburg.de/en>

¹⁴⁴ The water management system of Augsburg was chosen according to criteria 2 and 4 of the OG.

¹⁴⁵ It is still today the capital of the district of Swabia (Schwaben), with about 300,000 inhabitants.

¹⁴⁶ They were the stepchildren of the Roman Emperor Augustus, who died in 14 AC.

then on guilds. In this context, the city's water management system took shape about 800 years ago. The experienced city engineers were very careful in damming and redirecting the water of the rivers Lech, Wertach and Singold to reach the entire city. For their achievement, they are considered the European forerunners. Elements such as the Hochablass (1346), the Aqueduct with the water towers (1416), and the Galgenablass (1500) composed the embryonal Red Gate Waterworks system, the oldest existing structure in Germany and in Central Europe. This is one of the most significant features of this UNESCO World Heritage Site.

At the turn of the 15th and 16th centuries, the city reached its heyday, thanks also to the investments of two of the most influential and richest families of the Middle Ages, who had perhaps even greater importance than the Medici in Renaissance Italy. These families were the Welser and the Fugger, merchants and bankers of the popes and Emperor Charles V. In particular, the latter family reflects surprisingly the contradictions of the 16th century. It got rich by financing the powerful of the time, later obtaining concessions¹⁴⁷ and favors. This time comes just before the Protestant reform when the sale of indulgences reached exorbitant sums. This is one of the many earnings this family could count on, without considering the speculations in the Old and New World with the emperor. In contrast to this corruption, the Fuggers considered themselves fervent devotees, financing also the Fugger Chapel, between 1509 and 1517, designed by Albrecht Dürer, in St. Anne's Church in Augsburg, according to the Italian Renaissance style. Furthermore, the construction of the popular Fuggerei district was also financed by the Fuggers in 1521 (Steinmetz, 2016). It was a place where Augsburg's needy citizens could find accommodation. It is the oldest example in the world of public housing¹⁴⁸ still existing and one of the most important attractions of the city even today. The founder, Jacob Fugger, lived from 1473 to 1478 in Venice¹⁴⁹ as a representative of the family business. Here, he had the opportunity to broaden his knowledge of commerce and get in touch with the Italian Renaissance. This is why the structure of the Fuggerei was affected by the influences of the architecture of Venetian public houses. Indeed, the Fuggerei shows particular structures that also characterized the innovative buildings¹⁵⁰ in Venice in the 16th century. Jacob Fugger had the first houses built in 1516; 52 were built in 1523 and 67 with 142 apartments are still used today. The rent of the Fuggerei was (and still is) one Rhine Florin per year (0.88 euros

¹⁴⁷ Augsburg was an important textile center, thanks to the main available waterways.

¹⁴⁸ Even if the Corte di Ca' Lando in Padua precedes it by eight years (1513).

¹⁴⁹ This is another indirect but fundamental link with Venice.

¹⁵⁰ The terraced houses arranged in parallel rows, the division of the same into apartments on different floors, and the division of space in an equal and functional way are some examples.

today) and three prayers a day for the founder of the Fuggerei. The criteria for being eligible to live there are still the same today as in 1521: one must be born in Augusta, be Catholic, and indigent. The gates are closed at night (every day after 10 p.m.), so the Fuggerei is like a small independent medieval town¹⁵¹.

Although the city's heyday was over due to the German wars between Catholics and Protestants¹⁵², providing citizens with clean drinking water maintained an important impact on the development of the city. Water was pumped thanks to the principle of the "communicating vessels" using some pistons, and a wide system of wooden pipes called "Deicheln" guaranteed the transfer from the aqueduct up to the numerous fountains in the upper town¹⁵³. The city architect Elias Holl (1573-1646) also set new standards for hygiene when the Stadtmetzg (the town butchers' house) was built. Holl was able to solve two common hygiene issues in meat processing sites of the time. The flowing water was used to cool the meat and keep it fresh. Besides, the fast-moving waters in the Lech canal disposed of the waste quickly and efficiently. The increase in population (after the drop due to the plague in 1630) led to further developments of the area with the creation of numerous water towers and fountains for domestic and aesthetic use between the 17th and 18th centuries. Moreover, technological progress concerning water never stopped, as witnessed by the city fountain master Caspar Walter (1706-1769), whose name was well known throughout Europe. Some of the models of his revolutionary inventions can still be admired today in the Maximilian Museum. If the abundance of water in Augsburg had already been an important factor for the textile sector in previous centuries, in the 19th century this abundance was even more decisive for the location of industries. Turbines provided most of the energy needed by the 1840s. The result was the rapid expansion of textile and paper production, as well as the production of machinery and turbines. Thus, together with industrial development, the energy demand also began to steadily increase in the 19th century. This need was covered by the creation of the first large hydroelectric plants. At the convergence of Lech and Wertach, the turbines of the Wolfzahnau power plant have been providing electricity since 1901. The hydroelectric power plant is still in operation and is located in the Wolfzahnau nature reserve. The flywheel generator that was integrated into the plant was even celebrated at the 1900 Paris Universal Exposition as a showpiece for state-of-the-art German engineering. Another power plant is in Gersthofen and aimed to satisfy the entire electricity demand in Bavarian Swabia. It first supplied energy for the

¹⁵¹ For further information, this is the link to its website: <https://www.fugger.de/en/fuggerei.html>

¹⁵² Here the peace of Augusta was signed between Catholics and Protestants in 1555.

¹⁵³ All the 22 elements will be described in detail after the historical description.

Hoechst company factory (in the chemical sector), followed by other large companies such as Lech Steel Works. Many of them have survived to this day.



*Figure 16 – Planinghaus Architekten for The Water Management System of Augsburg (Sandra Kaiser)
Source: Whc.unesco.org¹⁵⁸⁰ - Year: 2021*

Despite the numerous damages suffered by the city during the allied bombings in 1942 and 1944, the city water system resisted better than the residential one. Just about thirty years later, the city experienced some opportunities of redemption. The first one was the foundation of the public university in 1970 including six faculties: Business and Economics, Philosophy and Social Sciences, Philology and History, Law, Natural Sciences and Materials Engineering, Mathematics, and Catholic Theology (to which the course of Computer Science and Medicine were added in the 2000s). The second one was the 1972 Munich Olympics¹⁵⁴. In 1970, the world's first artificially created whitewater¹⁵⁵ course emerged from the Eiskanal (Ice Channel), originally designed to prevent floating ice from entering the city. This launched the German national training center for canoe slalom and whitewater, which is located directly on the Olympic field. Many German medalists prepared for their success here. Even today Augsburg conveys the impression of being an enjoyable place rich in water, with numerous rivers, canals, fountains, swimming pools, parks, natural and artificial lakes. A final aspect to consider is that this city is situated in the middle of the so-called "Romantische Strasse". This is a route¹⁵⁶ about 400 kilometers long that has existed for over 70 years, and which crosses 29 locations from Fussen (on the

¹⁵⁴ Augsburg was strongly involved, starting from the Olympic flame that was officially lit there.

¹⁵⁵ Whitewater kayaking is a relatively new sport that offers the thrill of driving a kayak in vigorous waters, facing waterfalls, and directly challenging the raw power of nature.

¹⁵⁶ Link to the official website: <https://www.romantischestrassen.de/>

border with Austria) to Würzburg, crossing western Bavaria vertically. This route is famous for its beauty given by the presence of medieval towns and castles frozen in time, unspoiled nature with many rivers, lakes, and forests, and some other UNESCO sites. In particular, there are three of them along the way, in addition to that of Augsburg. The first one¹⁵⁷ is the beautiful Residence of Würzburg with its Court Gardens, considered an 18th century artistic and architectural masterpiece, thanks to the work of Tiepolo and Neumann. The second site is “the Frontiers of the Roman Empire”¹⁵⁸ with the remains of the old Upper Germanic-Rhaetian Limes (plenty of fortresses, watchtowers, walls, and palisades) with which this former world power bounded its empire from “barbarian” Germany. The third UNESCO site¹⁵⁹ is the exceptionally well-preserved Pilgrimage Church “Die Wies”, a brilliant creation of Bavarian Rococo and a testament to the religious traditions living in that area.

To better understand the complexity and ingenuity of the site, it is useful to analyze in depth the 22 physical elements¹⁶⁰ of the water system in Augsburg, spread over 30 kilometers (City of Augsburg - Office of the UNESCO World Heritage, 2020). These elements are divided into five¹⁶¹ main classes: 1) the power plants, 2) the drinking waterworks, 3) the fountains, 4) the water engineering structures, and 5) the water courses and canals. The first group is the largest category, as it includes 10 out of the 22 elements, testifying to the long sustainable tradition of the city. These plants still satisfy most of the energy and electricity needs of the surrounding neighborhoods and companies, with percentages close to 50% in some areas. The second category is the oldest one, including some historic water towers about 500 years old, in four strategic city points, perfectly maintained over time and integrated into the landscape. The third group is the most artistic category, with three extraordinary fountains built at the end of the 16th century. The

¹⁵⁷ The Würzburg Residence was chosen according to criteria 1 and 4 of the OG.

¹⁵⁸ The Frontiers of the Roman Empire were chosen according to criteria 2, 3, and 4 of the OG.

¹⁵⁹ The Pilgrimage Church of Wies was chosen according to criteria 1 and 3 of the OG.

¹⁶⁰ This is the complete list of the 22 elements: 1) Hochablass (or Lech Weir), 2) Lech Canals, 3) Galgenablass (or Culvert), 4) Waterworks at Rotes Tor, 5) Lower Waterworks, 6) Waterworks at Vogeltor, 7) Augustus Fountain, 8) Mercury Fountain, 9) Hercules Fountain, 10) Stadtmetzg, 11) Waterworks at Hochablass, 12) Power Plant at the Stadtbach, 13) Power Plant at the Fabrikkanal, 14) Power Plant at the Singold, 15) Power Plant at the Wolfzahnau, 16) Power Plant Gersthofen, 17) Power Plant at the Senkelbach, 18) Power Plant Langweid, 19) Power Plant at the Wertachkanal, 20) Power Plant at the Proviantbach, 21) Power Plant Meitingen, and 22) Canoe Course (or Eiskanal).

¹⁶¹ This classification is not necessarily so strict. Some elements can fall into several categories, as for points 1 and 4, or 4 and 5. The classification presented in this paragraph is just one of the most recommended interpretations.

sculpted subjects of the fountains refer to three main city aspects. The first¹⁶² concerns its ancient foundation, the second¹⁶³ refers to its wide commercial tradition and the third¹⁶⁴ reminds of his strength and pride. The fourth category of elements of the water system is the most innovative group for the time, as it includes elements such as the Hochablass (or Lech weir) for process water management throughout the area, or the Stadtmetzg for the innovative use of water in the food sector to keep meat fresh and dispose of waste. The fifth and last group includes the three remaining elements summarizing all the previous aspects, showing the beauty and functionality of a city based on canals for energy production, the livability of the city, the aesthetics of the place, the innovations developed, and the recreational and sporting purposes. All these places can also be discovered virtually, thanks to a digital map and a detailed site plan (City of Augsburg - Office of the UNESCO World Heritage, 2020) available on the website. There is also a listening tour downloadable directly on any phone called “Water Experience in Augsburg”, which covers about 5 kilometers of the route for a duration of 2 hours and 30 minutes. Other four shorter physical thematic tours are suggested as well.

Although the Coronavirus pandemic has slowed down the likely increase in tourism promoted by the UNESCO recognition, Augsburg has proudly continued to develop in recent times. For instance, on March 22nd, 2021, coinciding with World Water Day, a new info point on the city’s water system was inaugurated by the mayor Eva Weber and Jürgen Enninger, city consultant for culture, world heritage, and sport. The World Heritage Info Center is housed in the former rooms of the Stadtparkasse in the municipal administration building, after an intervention of about two years and a cost of 800,000 euros. The center illustrates the complex water system in images and texts, serving as the first point of contact with Augsburg’s world heritage and its historical 22 elements. Jürgen Enninger himself commented the event as follows:

Ziel des Info-Zentrums ist es, einen ersten Eindruck vom Augsburger Welterbe, das sich über 30 Kilometer erstreckt, in einem Zusammenhang zu bekommen. Wir wollen das Wassersystem anschaulich und erlebbar machen, Begeisterung wecken und verdeutlichen, warum Augsburg Welterbe ist. Dieser Ort soll einen Anstoß für

¹⁶² The first fountain depicts the emperor Augustus (who was also the founder of the city) with four other figures around him representing the river courses of the area.

¹⁶³ The second fountain depicts a cupid at the feet of the god Mercury, intent on untying his sandal to keep the god of commerce in the city, thus guaranteeing his wealth.

¹⁶⁴ The third fountain depicts Hercules defeating the hydra and excelling in the waters.

Interessierte geben, sich auf den Weg zu machen und die spannenden Objekte vor Ort zu erfahren¹⁶⁵ (Kultur Bürgerservice & Rathaus, 2021).

It is also possible to watch the video¹⁶⁶ of the inauguration. For the first-time miniature models, many multimedia explanations, augmented reality glasses, local products and souvenirs are shown inside the rooms and the shop. Another important aspect that is emphasized in the video concerns the value¹⁶⁷ of water, too often underestimated but capable of significantly influencing the ecological, social, and cultural dimensions.

The present study of the water management system of Augsburg has highlighted the importance of sustainability as a fundamental aspect of the city. Further proof of that is the 25-years city portal dedicated to this topic exclusively, and the numerous awards won thanks to the city commitment, in particular those in 2013 (the most prestigious) and 2020 (the most recent) are noteworthy. The city portal was the starting point of this process. Many citizens and different groups were involved since the mid-1990s in the process¹⁶⁸ of the “Local Agenda 21 for a Sustainable Development” in Augsburg, later updated with the 2030 Agenda. The basic idea was to establish a long-term and cooperative urban evolution intended to be systematic, holistic, transparent, participatory, and integrated. All the projects and reports from this experience have been developed following four guidelines: ecology, society, economy, and culture. Moreover, the language used is simple and direct, rich in mathematical indicators, providing a concrete framework for the various contexts. All this was made possible by an advisory committee of 26 experts, who supported citizens and developed all the ideas and plans. The work carried out, however, also goes beyond municipal boundaries and often deals with macroeconomic issues¹⁶⁹. Many different awards could be analyzed in this regard. We will focus on the most significant and recent ones to illustrate how a bottom-up system¹⁷⁰ can be so effective.

¹⁶⁵ This is our translation of Enninger’s speech in English: “The aim of the information center is to get a first impression of Augsburg’s world heritage, which extends over 30 kilometers in a single location. We want to make the water system clear and tangible, spark excitement and make it clear why Augsburg is a world heritage site. This place is meant to provide a stimulus for those interested in living and experiencing the exciting objects on site”.

¹⁶⁶ Link to the opening video: <https://www.youtube.com/watch?v=rjEiERp42HI>

¹⁶⁷ For an in-depth analysis of the value of water in different fields, we refer to the first part of the present thesis.

¹⁶⁸ In December 2019, the Local Agenda 21 for the sustainability of Augsburg, involving many actors, even received recognition from the German UNESCO Commission and the Federal Ministry of Education and Research as an excellent education programme for sustainable development (ESD).

¹⁶⁹ For further information: <https://www.nachhaltigkeit.augsburg.de>

¹⁷⁰ This aspect is linked to the second chapter of the present thesis.

The first award was the “German Sustainability Award for Cities and Municipalities”, won on November 21st, 2013 against 108 competitors. In that edition, Augsburg, Pirmasens, and Pfaffenhofen were the Germany’s most sustainable large, medium and small¹⁷¹ cities. Each of them obtained a huge cash prize of € 35,000 from the Allianz Environmental Foundation, to be used to establish or create new sustainable projects. Augsburg invested this award in the Internet sustainability portal¹⁷² “Lifeguide-Augsburg”, as well as in the urban gardening project “City Farm”. In this way, the city has combined an environmental strategy for biodiversity with a socio-economic one for businesses and citizens (Portal Allianz Umweltstiftung, n.d.). The first project will be later described together with the second award of 2020, as it was the winner of a prestigious national prize. The second project instead deserves more attention. The City Farm¹⁷³ consists of a communitarian-agricultural urban area in the north of the city, managed voluntarily by the initiators Vogt and Reményi-Vogt, together with other 15 members. Here, neither electricity nor water is used, substituted by solar panels on the roof of the workshop and rainwater. The farmland includes a small fruit litter lawn, a pond and offers chickens and rabbits a suitable home. The issues this initiative intends to address deals with the absence of city gardens. This lack is particularly felt by children who need freedom of movement and a free approach to nature. The City Farm addresses this deficit and provides children and adults with a familiar space, by welcoming visitors twice a month. Lastly, having such a low budget reinforces the implementation of a do-it-yourself (DIY) strategy, while also promoting bartering and mutual aid. Therefore, the farm offers people a good place where they can test themselves and discover their skills.

The second award won by Augsburg was the “Project Sustainability Award” in 2020, Augsburg being one of the 40 winners out of 372 competitors. As previously mentioned, the winner was the portal “Lifeguide-Augsburg”¹⁷⁴ for its “exceptional and effective commitment for a future suitable for grandchildren” (*Der Lifeguide Augsburg ist Projekt Nachhaltigkeit 2020!*, 2020). It consists of an Internet portal for sustainable consumption and lifestyle in Augsburg and its surroundings, encouraging people to take responsibility for a fairer future. The portal content – articles, places, dates, and links – deals with concrete ecological, economic, social, and cultural themes, accessible independently by visitors. The most interesting aspect concerns its financing. This Internet portal is not commercial and is free of advertising. The portal wants to be independent and committed

¹⁷¹ In 2013 Augsburg had 265.000 inhabitants, Pirmasens 40.000 and Pfaffenhofen 24.000.

¹⁷² This project was awarded in 2020 as we will discuss later.

¹⁷³ Link to the official website: <https://cityfarmaugsburg.wordpress.com/59-2/>

¹⁷⁴ Link to the official website: <https://www.lifeguide-augsburg.de/>

only to sustainable thinking. Most of the funds come from awards such as the aforementioned “German Sustainability Award” of 2013. Regarding daily operation, the contribution of various public and private bodies¹⁷⁵ is still fundamental. Besides, the site is managed by the non-profit association Lifeguide Region Augsburg. The “Project Sustainability Award” is awarded once a year by the Council for Sustainable Development (RNE¹⁷⁶) and the four centers of the regional network for sustainability strategies (RENN¹⁷⁷). After years of work, this portal presents about 350 sustainable places and organizes special guides and city tours. The most striking example of this collective effort is the book including all the information present in the portal and available since December 2018. Even the book itself is strongly sustainable, as its entire content. It was printed by the Senser environmental printer on 100% recycled paper with organic inks without mineral oils and cobalt, from over 70% renewable raw materials¹⁷⁸.

In conclusion, all these sustainable city initiatives also involved the local university. Here, a sustainability working group has existed for years supporting numerous projects and PhDs on environmental issues. One of these is the recent Augsburg-Munich international doctoral program “Rethinking Environment: The Environmental Humanities and the Ecological Transformation of Society”¹⁷⁹. It is based at the WZU Center for Environmental Sciences (Augsburg) and the Rachel Carson Center (Munich). The program invites graduate students from all over the world and from a wide range of sectors. It offers “a unique opportunity to pursue a PhD degree examining the ecological transformation of society from an interdisciplinary perspective within an intellectually inspiring environment that brings together the international and regional expertise of its many partners and networks” (Rachel Carson Center for Environment and Society, n.d.). Many different disciplines are dealt with in-depth¹⁸⁰. The program languages are English and German only. This program is continuously supported by international guest professors, experienced professionals, creative artists and writers whose work focuses on environmental topics. In this regard, the university's publication on Environmental Humanities deserves to be mentioned (Schmidt

¹⁷⁵ This is the main list: the Regio Augsburg Wirtschaft, the Stadtwerke Augsburg Holding, the Schubert bakery, the Stadtparkasse Augsburg and the Paritätische St. Martinsstiftung.

¹⁷⁶ Link to the official website: <https://www.nachhaltigkeitsrat.de/>

¹⁷⁷ Link to the official website: <https://www.renn-netzwerk.de/>

¹⁷⁸ Link to the official website and the related book's information: <https://www.lifeguide-augsburg.de/magazin/buchtipps-lifeguide-reisefuehrer-fuer-augsburg-und-die-region>

¹⁷⁹ Link to the official website: <https://www.uni-augsburg.de/en/forschung/einrichtungen/institute/wzu/studium/idk/>

¹⁸⁰ Some of them are American Studies, Anthropology, Geography, Economics, Environmental Ethics, Environmental Health Sciences, Environmental Humanities, Environmental Philosophy, History, Human Geography, Global Studies, Theology, Scientific and Technological Studies.

et al., 2020). Besides, the WZU's commitment to Environmental Human Sciences is witnessed also by other university courses, such as the master's level course in Environmental Ethics. It is based at the Catholic Theological Faculty and is closely linked to the WZU and its interdisciplinary network of Environmental Humanities. Thus, a further link between Augsburg and the city of Venice can be drawn, as Ca' Foscari University of Venice recently inaugurated a master's degree program in Environmental Humanities that presents so many analogies¹⁸¹ with the one in Augsburg.

¹⁸¹ A collaboration between these two master's programs in the future would be truly productive.

Conclusions – Future water developments beyond the 2030 Agenda

Right from the initial title of the present master’s thesis, the declared purpose of this work was to rethink water management through a long-term sustainable and holistic strategy, capable of enhancing many different realities such as UNESCO World Heritage Sites¹⁸². The careful choice of words and their arrangement in the title is intended to summarize the entire dissertation. Indeed, rethinking water management is the main topic addressed in this research, looking at both future hopes and present contradictions. Besides that, “sustainability” is the first keyword analysed in the introduction. The concept of sustainability has been illustrated from a historical perspective to show its evolution until today, dealing with four related aspects: environment, society, economy, and culture. Sustainability is one of the most important concepts of our time, as highlighted by the ongoing environmental-health crisis, but it is extremely hard to describe concretely. The reason for this difficulty can be found in the second keyword: “holistic”. Indeed, what is still missing, or at least not understood by everyone, is the need for a holistic approach to put into practice all those different analyses and projects together. Hence, sustainability is no longer just a concept, it becomes an integrated system, where public and private support each other to consume less and improve more. The basic idea is that any action made in a certain sector influences many other fields, generating greater value or benefit. Regarding water, the importance of this element is undeniable as it creates synergies among many sectors as few other elements do, as explained in the first four chapters. The content of these chapters can be briefly synthesised according to the 17 goals of the sustainable action program presented in the 2030 Agenda¹⁸³.



¹⁸² Italy and Germany were specifically considered to make some comparisons because they are well-known by the author, but other water-related UNESCO sites in the world could be discussed.

¹⁸³ Signed in 2015 by the governments of the 193 UN member countries, it includes 17 Sustainable Development Goals (SDGs), divided into 169 sub-targets, to be achieved by 2030. All the information presented in this paragraph will be taken from the official website: <https://www.un.org/sustainabledevelopment/>

Figure 17 - The 17 Sustainable Development Goals
Source: Savethechildren.it - Year: 2021

Two goals are particularly linked with water. The most important one is the sixth goal – called “Clean Water and Sanitation” – which aims to guarantee everyone water availability and optimize its management. This thesis was conceived especially according to this goal, pointing out the lack of modern infrastructure and even more the lack of a holistic approach to the sustainable use of water. The other main goal related to water is number fourteen – called “Life below Water” – which shifts attention to a more sustainable use of oceans, seas, and coasts. Given the breadth of the topic, this specific issue has not been strongly developed in the present research, but it has been addressed in some points, especially talking about tourism, energy, and biodiversity conservation. The two objectives above mentioned focus on water security as a fundamental requirement of subsistence, to which food and energy can also be added. These two points refer to as many objectives of the 2030 Agenda. One is the seventh goal – called “Affordable and Clean Energy” – which aims to ensure access to economic, reliable, and sustainable energy systems for everyone. This topic was analysed in Chapter 4.3 considering how water could affect this sector with tides, waves, and sea currents. The other goal linked to food is the second one – called “Zero Hunger” – which aims to end world hunger by improving nutrition thanks to a more sustainable agriculture. This issue was illustrated in Chapter 4.2, considering how water could be optimally used to increase agricultural production thanks to some new technologies. The combination of these three resources (water, energy, and food) is considered the base of subsistence, so much so that they are counted in a special national index called the “WEF Nexus Index”¹⁸⁴.

The numerical value thus obtained also acts as a reference for some other related objectives of this sustainable plan. One is the first goal of the 2030 Agenda – called “No poverty” – which will fail for sure if human basic needs are not primarily covered, as suggested by the famous pyramid of Maslow with its “Hierarchy of Needs” (1954)¹⁸⁵. Furthermore, the current socio-economic models need a radical change to develop more respectful, inclusive, and resilient realities. This awareness is emphasized by many social goals such as the fourth and the fifth goals of the 2030 Agenda– called “Quality Education” and “Gender Equality” – that have been illustrated in this research as well. In particular, the second

¹⁸⁴ Link to the official website: <https://wefnexusindex.org/>

¹⁸⁵ According to this model, each individual realizes himself by passing through various progressive stages. They are divided into five categories: physiological, safety and protection, belonging, esteem, and personal fulfilment. This scheme was later updated by Maslow himself, but this goes beyond the scope of the present study.

chapter entirely focuses on a new ecological education that could spread more sustainable attitudes and behaviours. But the analysis can also be extended to the economic sphere, thanks to goals eight and tenth, called “Decent Work and Economic Growth” and “Reduced Inequalities”. In fact, the third chapter underlines the necessity for more circular and sustainable economic models and investments, such as for the already mentioned “Blue Economy”, especially intended to reduce waste, and therefore indirectly reduce inequalities. The combination of these improvements would bring long-term benefits to many sectors and places. In this regard, the cities are the protagonists that will be called to carry out this challenge. It is no coincidence that there is more and more interest around the so-called “smart cities”, not only for the disruptive role of technology but also for some other aspects such as leadership, entrepreneurship, social and human capital (Boes et al., 2015). This consideration is linked with two further goals of the 2030 Agenda: the ninth and eleventh goals, called “Industry, Innovation and Infrastructure” and “Sustainable cities and communities”. These issues were addressed in the fourth chapter of this thesis, providing updated information on water that should be considered by these global growing¹⁸⁶ areas.

The remaining six goals of the 2030 Agenda are not immediately linked with water, but this element still manages to influence them. The first one is the third goal in the Agenda – called “Good Health and Well-being” – which has taken on even greater importance due to the Coronavirus crisis and the increasingly global indiscriminate pollution of air and water. The second and third objectives are respectively the sixteenth and seventeenth goals of the 2030 Agenda – called “Peace, Justice, and Strong Institutions” and “Partnerships for the Goals” – which are taken into consideration in the first paragraph of the third chapter, talking about water geopolitics. These aspects will be fundamental in the future, considering how many conflicts could arise for water control, as it is already happening in some countries, especially in the Middle East and Africa. The remaining three goals are the twelfth, thirteenth and fifteenth goals – called “Responsible Production and Consumption”, “Climate Action” and “Life on Land” – which could be seen as a summary of the whole sustainable plan as well as of this thesis. The main objective is to reduce the consumption of resources, possibly trying to reverse the current trend. A proper example of this last consideration is the issue of desertification¹⁸⁷ caused especially by global warming and too invasive agricultural and industrial production patterns (Neri, 2021). The first problem is

¹⁸⁶ As reported by ASviS and according to the United Nations “World Urbanization Prospects 2018”, in 2050 almost 70% of the world population will live in urban areas.

¹⁸⁷ As reported by LifeGate and according to the Global Atlas of Desertification published in 2018, around 90 percent of global soil will be degraded (with varying degrees depending on the national policies implemented) by 2050.

supported by another issue called deforestation¹⁸⁸. It is one of the main causes of biodiversity loss and lack of carbon dioxide absorption, to which is added the production of CO₂ during the combustion of wood and plants. To these examples many others could be added. The final result is a huge rise in temperature over the past thirty years, which increases the melting of polar and mountain glaciers worldwide extremely quickly.

The second part of this thesis, namely from Chapter 5 onwards, focuses instead on some practical examples of what was previously explained in theory. In this regard, UNESCO is one of those organizations that has pursued, since its origins, the enhancement and maintenance of cultural and natural places worthy of global interest. The original idea for the present study was to illustrate only two realities that had received this formal recognition thanks to the historical relationship between man and water. These places involve two cities and their surroundings, namely Venice in Veneto and Augsburg in Bavaria. Nevertheless, many other Italian and German UNESCO sites linked with water for historical, urbanistic and landscape reasons were soon discovered by searching for more information. Therefore, it was decided to enlarge the discussion, also drawing some short comparisons between further sites that were the most suitable to the discussion. This is the structure of the last four chapters, where the first two – Chapters 5 and 6 – include nine brief comparisons¹⁸⁹, Chapter 7 focuses on Venice, and Chapter 8 on Augsburg. In this way, the comparisons act as a preview of the more in-depth analyses of the two cities that were selected for this study. Special attention was given to how much water can influence these places, offering them not only a better aesthetics but also improving the functional aspect of these areas, where history and nature blend together for the benefit of anyone.

There are many other examples that could be added to show the relevance of water in sites of considerable importance. Talking one more time about UNESCO, it might be useful to mention two related realities: Biosphere Reserves¹⁹⁰ and Global Geoparks¹⁹¹. Biosphere

¹⁸⁸ According to the 2020 Report of the National Space Research Agency (INPE), an average of 30 million hectares of forests are destroyed worldwide, equal to one football field per second.

¹⁸⁹ This is a summary of the sites illustrated: 1) The prehistoric pile-dwelling villages in Italy and Germany; 2) The Italian Maritime Republic with Venice, Pisa, Amalfi, and Genoa; and the German Hanseatic League with Lübeck, Wismar-Stralsund, Bremen, and Hamburg; 3) The vineyard landscape of Veneto and Liguria; and the Upper Middle Rhine Valley adding the Dresden delisting case; 4) The Aeolian Islands and the Frisian Island in the Wadden Sea; 5) The city of Mantua with Sabbioneta and the town of Bamberg; 6) Villa d'Este in Tivoli and the Bergpark Wilhelmshöhe in Kassel; 7) The botanic garden of Padua and the Dessau-Wörlitz Garden Realm; 8) Ferrara with the Po delta and the Muskauer park among the Lusatian Neisse; and 9) The royal palace of Caserta and the palaces of Potsdam with Berlin.

¹⁹⁰ Link to the official website: <https://en.unesco.org/biosphere>

¹⁹¹ Link to the official website: <http://www.globalgeopark.org/>

Reserves have been a fundamental part of the MAB Program¹⁹² for fifty years. This intergovernmental plan tries to establish a scientific basis to improve the link between people and the environment. It combines natural and social sciences to strengthen human living conditions and safeguard natural ecosystems, using innovative development approaches that are socially, culturally, and environmentally sustainable. The World Network of Biosphere Reserves currently counts on 714 sites in 129 countries, including 85 sites in Africa, 33 sites in the Middle East, 157 sites in Asia and the Pacific, 130 sites in Latin America and the Caribbean, and 302 sites in Europe and North America. For the scope of this thesis, it is important to mention the 19 sites¹⁹³ in Italy and the 16 sites¹⁹⁴ in Germany. Regarding Global Geoparks, they have similarities with the previous group. Here, some geographical areas of international geological interest are managed with a holistic approach of protection, education, and sustainable development. There are currently 169 UNESCO global geoparks in 44 countries, including 11 in Italy¹⁹⁵ and 7 in Germany¹⁹⁶. Many of these places have a strong link with water thanks to their seas, rivers, or lakes.

Going back to the title of the present work, the last aspect that we have not yet analysed is the concept of long-term. The 2030 Agenda is certainly the global reference point for a more sustainable future. That is why it has been illustrated in these conclusions in relation to the various arguments developed in our study. Nevertheless, there is a risk of misinterpreting the UN plan. Many perceived it as a point of arrival, as if the numerous existing problems could be solved only by reaching certain common goals. The reality is, however, much more complex, and this plan must be seen only as a starting point, to be followed by a substantial change in human behaviour. For the scope of this thesis, information and examples of water improvements that go even beyond the 17 goals of the

¹⁹² Link to the official website: <https://en.unesco.org/mab>

¹⁹³ The 19 sites in Italy are: 1) Collemeluccio-Montedimezzo, 2) Circeo, 3) Miramare, 4) Cilento and Vallo di Diano, 5) Somma-Vesuvio and Miglio d'Oro, 6) Ticino and Val Grande Verbano, 7) Tuscan Islands, 8) Selve Costiere di Toscana, 9) Monviso Transboundary Area, 10) Sila, 11) Tuscan-Emilian Apennines, 12) Ledro Alps and Judicaria, 13) Po Delta, 14) Collina Po, 15) Tepilora, Rio Posada and Montalbo, 16) Monte Peglia, 17) Valle Camonica - Alto Sebino, 18) Julian Alps, and 19) Po Grande.

¹⁹⁴ The 16 sites in Germany are: 1) Elbe River area, 2) Thuringia Forest, 3) Berchtesgadener Land, 4) Wadden Sea and Hallig Islands, 5) Schorfheide-Chorin, 6) Spreewald, 7) South-East Rügen, 8) Rhön, 9) Waddensea of Lower Saxony, 10) Waddensea of Hamburg, 11) Oberlausitzer Heide and Teichlandschaft, 12) Schaalsee, 13) Pfälzerwald, 14) Bliessgau, 15) Swabian Alb, and 16) Black Forest.

¹⁹⁵ The Global Geoparks in Italy are: 1) Adamello-Brenta, 2) Apuan Alps, 3) Beigua, 4) Cilento, Vallo di Diano and Alburni, 5) Madonie, 6) Pollino, 7) Sesia Val Grande, 8) Rocca di Cerere, 9) Tuscan Mining Park, 10) Aspromonte, and 11) Majella.

¹⁹⁶ The Global Geoparks in Germany are: 1) Bergstraße-Odenwald, 2) Harz and Braunschweiger Land, 3) Swabian Jura, 4) TERRA.vita, 5) Vulkaneifel, 6) Thuringia Inselsberg - Drei Gleichen, and 7) Muskauer Faltenbogen / Łuk Muzakowa (between Germany and Poland).

2030 Agenda were presented. The aim was to propose more integrated and sustainable education and development systems based on a long and very long-term perspective. The 2030 Agenda is rather a medium to long¹⁹⁷ term project which defines the minimum global requests to be reached in the remaining nine years to save the Earth. Unfortunately, this milestone project is far from being successful and risks failure, especially considering the further slowdowns caused by the Coronavirus. In this regard, the UNSDG report titled *Shared responsibility, global solidarity: Responding to the socio-economic impacts of Covid-19* (2020) deserves to be mentioned. It shows updated data to present how the pandemic impacts on all the 17 goals of the 2030 Agenda, mainly with negative effects.

What prospects will there be in the near future for the 2030 Agenda then? On the one hand, there is the concrete possibility of missing the appointment with the indicated deadline. Maybe some future global issues will be used as excuses to obtain more flexibility on the timing or the percentage of objectives to be achieved. Time, however, is cruel and this delay could have irreversible consequences on the survival of our planet. On the other hand, there is the desired possibility to increase the efforts to reach the goals regardless of what will happen in the following nine years, without the certainty that this will save the Earth. The latter path was particularly highlighted during the last edition of the “Earth Day” held on April 22nd, 2021. On that day, a virtual summit was held by the United States President, Joe Biden, and attended by 40 heads of state and government. Here, the European Union promised again to cut greenhouse gas emissions up to 55% by 2030 compared to 1990 levels, while the USA will reach up to 50% by 2030 compared to 2005 levels, and China up to 65% by 2030 compared to 2020 (Basso, 2021). As already said, achieving these goals would already mean a lot but it would not be enough. It is therefore essential to make the transaction convenient for everyone and profitable even for those who have no interest in investing for the protection of the Earth. Nobody must be excluded from this challenge. Many similar ideas will certainly be developed again in the next climate conference to be held in Glasgow¹⁹⁸ in November 2021.

And what prospects will there be in the near future for the Earth? To really save the Earth, it is fundamental to change our point of view. All the aspects treated in this thesis still refer to ecological anthropocentrism and unfortunately not to ecocentrism. The first tries to

¹⁹⁷ The threshold value between medium and long term usually stands at five years. This is the reason why the 2030 Agenda is considered a medium to long term project, which is now getting closer and closer to becoming medium-term rather than long-term.

¹⁹⁸ COP26 will be physically held if the Coronavirus does not spread again, as for the Milan Pre-COP Summit together with the event “Youth4Climate: Driving Ambition” to be held between the end of September and the beginning of October.

reconcile the consumerist lifestyle of man with the conservation of the environment, with disappointing results due to human selfishness. The second, on the other hand, sees the conservation of the environment as a whole, or rather as an asset independent of man, considering the latter only as one of the many species existing on the planet. These two visions, while sharing the idea of sustainability, have different connotations based on some simple elements. In the case of ecological anthropocentrism, man's consumerism is still the indispensable center of his existence, even if reduced. In the case of ecocentrism, on the contrary, the actions are determined starting from a feeling of care and communion with the environment (Lampredi, 2020). Hence, the first keyword of this thesis, that is the concept of sustainability, is cancelled out in the second view, simply becoming the ecological everyday life. This conclusion is taken from the thought of the Norwegian philosopher Arne Næss, who introduced the concept of "ecosophy" as early as 1960. This term precisely proposes this reversal of perspective, speaking of the distinction between superficial and deep¹⁹⁹ ecology (Næss, 2010). Subsequently, other philosophers such as the French Félix Guattari and the Indian Raimon Panikkar have further developed this vision, while not lacking numerous criticisms on its effective practicability. The most interesting aspect of this last consideration is that this problem arose over sixty years ago, and humanity has not been able to face such a change, postponing actions to the present day. Hopefully, the combination of international collaborations, technological progress, better investments, and ecological education plans will bring us soon ever closer to ecologism.

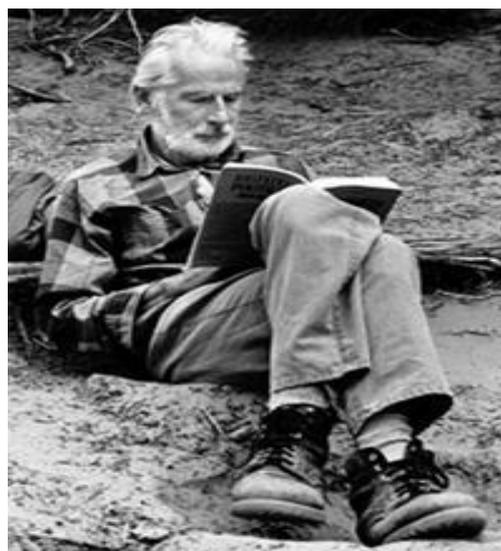


Figure 18 - The Deep Ecology Movement
Source: Deepecology.org - Year: 2021

¹⁹⁹ To deepen the subject, there is also a movement born in the 70s that takes up the teaching of this philosopher. This is the link to their website: <http://www.deepecology.org/deepecology.htm>

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