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The Industrial Terraforming of the Lagoon

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Notes

This contribution explores the industrial transformation of the Venetian Lagoon and its surrounding river basins, examining how large-scale infrastructural interventions, from Roman centuriation to twentieth-century hydroelectric and petrochemical developments, reshaped this complex intertidal ecosystem. Centred on the creation of Porto Marghera and the role of actors such as Count Giuseppe Volpi and the SADE company, it traces the lagoon's evolution into a machinic, energy-intensive landscape. The text highlights how modern industrial ideologies and interventions, including the controversial MOSE project, have compromised ecological balance, contributing to pollution, biodiversity loss, and altered hydrodynamics. By contrasting these legacies with emergent, unintended ecological niches – like those in the Casse di Colmata – the paper advocates for rethinking Venice's hydroscape through submerged, multi-species perspectives. It argues that this historical-ecological reading can inform more sustainable futures amid climate change and anthropogenic pressures.

The complex environment of the Venetian Lagoon, in constant flux and in search of equilibrium in the face of growing challenges, represents an intricately woven intertidal ecosystem, a landscape where the symbiotic relationship between nature and humans continues to unfold. Far from being a pristine ecosystem, the lagoon is a meticulously human-managed water domain, the complexity of which is now exemplified by the movable dams known as MOSE (Experimental Electromechanical Module). The controversial project, completed in 2019 after more than 20 years in the making, consists of movable barriers located at the lagoon inlets to occasionally separate it from the sea (with an effective operational life span of just 50 years) and attempts to reconcile the lagoon's existence with the spectre of climate change and rising sea levels. Echoing the plight of the denizens of our planet, Venice's inhabitants grapple with the intricacies of a threatened microcosm, making Venice a profound *planetary allegory* (Bevilacqua 1998). Rather than an immutable historical treasure, as the message often sold to crowds of tourists suggests, Venice is in fact the result of intense historical transformations in both of its architectural and landscape rationalities. The state of apparent equilibrium conveyed by the perpetual cyclical water conditions of the lagoon that pervades the city is the result of a vast, radical, transcalar series of interventions carried out over centuries. All these efforts have sought to maintain an artificial state of nature, a man-made lagoon environment. This lesson looks at this complex reality through the lens of the history of landscape architecture and industrialization.

The works carried out on a geographical scale in the hydro-basins of the Veneto region have had a radical impact on the state of the Venetian lagoon, including the Roman centuriation system, the *acque alte* (upper water network) initiated by the Etruscans, the fourteenth-century *acque alte minori* (minor lower water network) built by the Venetian Republic in the middle plain, and the *bonifica* (reclamation works) of the nineteenth and twentieth centuries in the low plain. They all contributed to the survival of Venice and its lagoon functions. The resulting hydroscape represents the *longue-durée* of the Venetian territory, the carrying structure of both the identity and spatial qualities of the cultural landscape of what developed as the Veneto *città diffusa*, which could be translated as 'dispersed city'. Before the MOSE's radical changes, aimed at preserving the city of Venice to the detriment of its lagoon, the decisive operations that significantly altered the state of the lagoon took place mainly in the late nineteenth century. In the early twentieth century, the modern visions of scientists, engineers and architects, but also painters and writers, projected a different future: a vision according to which the Venetian *hydroscape* would become an *enviro-technical wetland*. Indeed, the

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mountains in the background would be transformed to exploit the rivers and use the water to produce mechanical and electrical energy, while the lagoon marshlands would be filled in to accommodate industrial production activities. In the early twentieth century, both the rivers and the wetlands were therefore used to bring Venice into the Modern Age (Harvey 1989, 12).

Behind the idea of the modern transformation of the lagoon and, to a large extent, the mainland river basins into a productive mechanical landscape stood the same ideology and the same individuals. Known as the Gruppo Veneziano, they were a group of high-profile Venetians led by Count Giuseppe Volpi (1877-1947), a prominent local entrepreneur and future Finance Minister of the Fascist government. Under his leadership, they spearheaded the establishment of the industrial area of Porto Marghera, along the fringes of the Venice lagoon. At the forefront of this endeavour was a company called SADE (Società Adriatica di Elettricità, that is, the Adriatic Electrical Company), which pioneered the construction of dams and hydroelectric power plants along rivers, particularly along the Piave. Giuseppe Volpi envisioned the simultaneous transformation of the lagoon into a productive platform and the Alpine valleys into energy reservoirs, articulating a grand vision in which 'millions of kilowatt-hours' extracted from the mountain waters would breathe life into the stagnant lagoon, transforming – in his words – a *laguna morta*, a 'dead lagoon', into a *laguna viva,* a "living lagoon" (Volpi 1939). The project aimed to address Venice's stagnant state, characterized by economic desolation and confinement, an issue dubbed *Problema Venezia*. The establishment of petrochemical refineries in a newly built industrial area transformed Venice into one of the most important shipping terminals in Italy, in accordance with modernist visions of development.

Designed by engineer Enrico Coen Cagli, the project (1917) sought to terraform the lagoon by reclaiming vast swathes of wetlands in Bottenighi (larger than Venice itself), primarily to accommodate the energy-intensive petrochemical processes and oil refineries that were in high demand. Once a thriving tidal ecosystem serving as a transitional habitat between *terra firma*, or land, and the tidal environment of the lagoon, the marshlands of Bottenighi were swiftly occupied by factories. SADE's expertly coordinated initiatives demonstrated the company's significant role in regional industrial development. With the advent of hydraulic turbines in the early nineteenth century, alongside advancements in the manufacture of electrical components, the new possibility of harnessing water played a pivotal role in the re-territorialization process, which was facilitated by new hydraulic infrastructures. The development of power generators and machinery and distribution systems dictated extensive geographical patterns that, over the course of the last century, have systematically orchestrated all facets of production, transformation, accumulation, and distribution of resources, moulding the urban landscape of Veneto.

The SADE company controlled the production and distribution of energy across various Italian regions from 1905 until the nationalization of the electricity industry in 1963. The 'Volpi' thermal power plant, a coal-fuelled infrastructure, was built in 1926 to supply the growing industrial area of Marghera (later damaged by bombs during the World War II). By 1928, nearly sixty companies had set up their factories in the burgeoning industrial complex of Porto Marghera, which experienced exponential growth driven by the escalating demands of World War II. In this context, Marghera was envisioned as a pivotal point, receiving Alpine hydropower, and providing key petrochemical materials, serving as an industrial engine for the Italian Po Valley and a bridgehead to the Balkans and the Mediterranean. In this role, Porto Marghera was to become the counter-landscape of the Alps, the hydroscape of the mountain valley of the Piave River, the reciprocal landscape of the Venetian Lagoon.

In addition to land reclamation, this vision was made possible by major excavations across the lagoon to create a network of deep navigable canals. Among these, two had the most significant impact on the lagoon environment. Firstly, the 'Vittorio Emanuele Canal', dug in 1926 and widened after World War II, served the first phase

of the industrial project envisioned in 1917, designated as Industrial Zone I, covering 500 hectares. This operation was followed by the realization of Industrial Zone II, approved by the Fascist regime in 1925, and of the third area, Industrial Zone III , after the war (1963-69) (for another 1700 ha in total), strategically built on elevated terrain, protected against the ebb and flow of tides by the accumulation of dredged lagoon bed material and sediments. The subsequent excavation of the *Canale dei Petroli* (Malamocco-Marghera Channel) in 1968 further facilitated the navigability of the lagoon for industrial purposes, fostering economic growth based on petrochemical production, despite the environmental, health and safety hazards associated with it. This was accompanied by the reclamation of other relevant areas, such as the island of Tronchetto (1958) and the reclamation of wetlands in San Giuliano (1957).

The third zone of the envisioned industrial area ultimately remained largely undeveloped, a departure from the patterns observed in the first two zones. This can be attributed to significant interruptions and events that altered the trajectory of development. In the mid-1970s, in the midst of the 1973 oil crisis and the Yom Kippur War, a paradigm shift occurred. The prevailing systems were questioned, leading to discussions on ecology and the exploration of alternative energy sources beyond oil. At the same time, concessions in mountainous regions were halted, particularly for hydroelectric power. However, events such as the Vajont disaster in October 1963 and the nationalization of hydropower in the same year, followed by a severe flood in 1966, marked a turning point. These calamities underscored the hubris of unbridled technological domination of nature.

The construction of Porto Marghera ultimately had a profound impact on the lagoon ecosystem, causing extreme pollution and exacerbating the erosion of the seabed. Activities involving hazardous chemicals contributed to the environmental degradation due to inadequate regulation. The alteration of the direction of currents and the speed of the tides entering the lagoon from the Lido inlet, the digging of navigable channels (in particular the *Canale dei Petroli*), both physically and conceptually disrupted the equilibrium between the lagoon's inner 'basins' and the breaches of the conservation regulations, changing the balance between saltwater and freshwater marked by the so-called *parti-acque*, or watershed. Together, these events reshaped the industrial landscape, revealing the need for sustainable practices and environmental stewardship.

Today, the *Casse di Colmata*, artificial islands reclaimed from the lagoon and filled with soil dredged from the excavation of channels, stand as an example of environmental diversity, with mud, sediments, clay and tidal fluxes, while maintaining connections to the mainland. On those that have been abandoned and have never hosted industrial settlements, life has flourished in unexpected ways. The nature of the soil has led to a proliferation of species different from those native to the marshland. From the 1970s to the present day, the ecosystem has faced challenges such as saltwater intrusion and shifting currents, making it a hybrid site within the Venice Lagoon. While some *Casse* remain unmanaged, others are equipped with pedestrian walkways and birdwatching facilities. Notably, *Cassa di Colmata A*, which is uniquely connected to the mainland, supports specific biotopes and vegetation patterns conducive to the development and establishment of certain species. It is part of the Integrated Fusina Project, which has garnered attention from various institutions and is now recognized as Site of National Interest (*Sito di Interesse Nazionale* or SIN) for its unique species and vegetation. Managed for industrial purposes by the waste disposal company Veritas under concession from the Italian state, it boasts a network of channels for water distribution and phyto-depuration. *Cassa C*, located within the Municipality of Mira, suffers from invasive plant species, particularly *Baccarispiluralis*, or 'coyote brush', whose uncontrolled growth threatens the nativeflora. Tidal creeks and internal lakes, some freshwater and some saline, promote extreme salinity levels similar to desert environments, which in turn support unique species adaptations. These environments also provide space for non-native bird species to thrive.

The legacy of the industrial area of Porto Marghera, its ongoing functioning, requirements and externalities are intertwined with those of the MOSE, as well as with freight transport and the extractive tourist cruise industry. The lasting effects of modern and post-modern activities, marked by significant ecological changes, increased water currents and salinity, including the erosion of the lagoon bed, resulting in a decrease in oxygen levels and a loss of aquatic life (as by reported by local fishermen), make the vision of Venice as a brackish lake, deprived of its peculiar geomorphology and its more-than-human realms, clearer every day. The top-down approach to decision-making that has been adopted so far neglects local ecological knowledge and critical multi-species existence. Conditions such as those of the *Cassa di Colmata* may suggest the need to embrace an alternative, *submerged perspectives*, to challenge technocentric modernity and to offer alternative ways of knowing and relating to land and water (Gómez-Barris 2017), alternative ways of knowing, feeling and being in a renewed relationship between land and water. By dissecting industrial legacies through situated *submerged perspectives*, both in the lagoon and across the seemingly distant hydroscapes of rivers so related to its condition, we can extend Venice's *longue durée* and encourage the envisioning and flourishing of other futures.

To sum up, this historical-ecological overview of the transformation of the Venice Lagoon and its hydrographic basin into an industrial environment exemplifies the deep Anthropocene transformation of large ecosystems. In particular, it has focused on the modern legacy of the city's industrialization, including the changes affecting both wetlands and river basins, to explore the interconnectedness of these environments, which can be seen as reciprocal landscapes. The lesson encourages reflection on how we relate to the resulting ecosystems in the ongoing struggle to balance human and more-than-human needs with environmental conservation in the evolving context of climate change.

Mandatory Reading

Tagliapietra, D.; Umgiesser, G. (2023). "Venice and its lagoon fin de siècle". *Regional Environmental Change*, 23, 125. https://doi.org/10.1007/s10113-023-02120-4

Further Optional Reading

Bevilacqua, P. (1998). *Venezia e le Acque: una metafora planetaria*. Roma: Donzelli.

Cavazzoni, S. (1995). "La Laguna: origine ed evoluzione". Caniato, G.; Turri, E.; Zanetti, M. (a cura di), *La laguna di Venezia*. Verona: Cierre, 41-67.

Chinello, C. (1980). *Porto Marghera 1902-1926: Alle origini del 'problema di Venezia'*. Venezia: Marsilio.

D'Alpaos, L. (2010). *L'Evoluzione morfologica della laguna di Venezia attraverso la lettura di alcune sue mappe storiche e delle sua carte idrografiche*. Venezia: Comune di Venezia.

Gómez-Barris, M. (2017). *The Extractive Zone: Social Ecology and Decolonial Perspectives*. Durham: Duke University Press.

Harvey, D. (1989). *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change*. Oxford: Blackwell.

Madricardo, F. et al. (2019). "Assessing the Human Footprint on the Sea-Floor of Coastal Systems: The Case of the Venice Lagoon, Italy". *Nature Scientific Reports*, 9(1), 6615. https://doi.org/10.1038/s41598-019-43027-7

Nappi, A.F. (1994). *Storia Di Marghera: Da Periferia a Città. Mestre*. Marghera: Stamperia Cetid.

Petri, R.; Reberschak, M. (1993). "La SADE Di Giuseppe Volpi e La 'nuova Venezia' Industriale". De Rosa, L. (a cura di), *Storia dell'industria elettrica in Italia*. Vol. 2, *Il potenziamento dell'industria elettrica in Italia: 1914-1925*. Bari: Laterza, 317-46.

Volpi, G. (1939). *Venezia Antica e Moderna*. Roma: Atena.

Zucconi, G. (2002). *La Grande Venezia: Una Metropoli incompiuta tra Otto e Novecento*. Venezia: Marsilio.