

Theme 1 – A Sea At Risk: The Adriatic

Presentation -Venice: From Queen of the Sea to an Historical Centre at Risk

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The Rise to Power and the Decadence

Legend puts the birth of Venice in about the year 400 A.D. For centuries before, indigenous people had used islets in the lagoon as strategic locations for defence, traffic and fishery. The fact that they were surrounded by water and with a large network of waterways simplified trade. Separating the land from the sea, Venice lagoon offered all the means for rapid development of a marine city linked to both the Adriatic and the Mediterranean. Venice was in an ideal position to become a commercial and political bridge between the developed East with the growing Western European countries. By 800 A.D. the first Doge and a government were created, giving birth to a flourishing golden era that lasted for a millennium. St. Mark became patron of the city and his body enshrined in the Basilica.

By 1000 A.D., Venice was already the most powerful Marine Republic of the world with a large and safe harbour and the first industrial advanced shipyard of the world where military and commercial ships were built by the hundred. To supply the shipyard with wood, Venice occupied and governed Friuli and Dalmatia.

In 1204, under Doge Dandolo, the entire fleet for the 4th Crusade expedition was built in a very short time. It transported over 50,000 men and 18,000 horses through the Adriatic to the Orient, an accomplishment barely rivalled in history. Venice reinforced its dominion from the eastern coastline of the Adriatic as far as Constantinople, growing in power and wealth with the riches granted for its services to the Crusaders. Victory in the battle of Lepanto against the Turks in 1571, meant that the Doge became head of one-quarter of the Holy Roman Empire, a title that was practically kept until the end of Venice in 1797.

From the 16th to the 17th centuries large projects were realised to save the harbour and the lagoon from silting up with sediment runoff. The rivers Sile, Dese

and Brenta were diverted to run around rather than into the lagoon. Works of art and treasures were enriching the city; splendid palaces, monuments, churches and landscape were created for prestige and pleasure, gradually leading to an elegant decadence. The aristocratic government became weak, competition at sea from other marine cities grew, and Venice became easy prey for General Bonaparte's invasion in 1797. It was the end of Venice as a *Queen of the Sea*; and no concerted efforts to revive her were to be made until the 20th century.

In the 1930s, convinced that Venice could benefit from the rising industrial era, the government set up petrochemical industries on the edge of the lagoon, three miles from Venice. The danger of industrial pollution and the effect of waste disposal was neither understood nor predicted. At the same time the long bridge linking Venice to the mainland was built, exposing the city to new changes and wheeled traffic. Two-thirds of city residents gradually migrated inland. Since the 1950s the population in the historical centre has declined from 130,000 people to the present 65,000. Many firms, commercial, public and private activities, and even part of the University have been transferred inland.

Vulnerability of Venice to Climate Change

In 1966 the largest Venice flood of the century shocked the world. UNESCO declared Venice a site of global cultural importance to be saved and conserved. In 1968 the Italian government gave new support to science and technology to acquire the knowledge required to safeguard the city. For over 35 years legal, economic, scientific and technical issues were debated and a great deal of knowledge has been acquired with integrated approaches. Population consensus, however, was not properly solicited nor obtained. Unfortunately, this has delayed important decisions.

In the 1970s the international scientific community warned the world about global climate and environment change, and the risk of a rise in mean sea level. The consciousness of Venice's vulnerability increased, but costly preventive actions met financial problems and were bogged down in political intrigues. Despite all this,

engineering projects for the defence of Venice from extreme floods have progressed. They are ready to be approved and could be ready to operate within 5 to 10 years.

The role of science in the protection of Venice has been to understand, simulate and predict the global and local environmental and climatological changes and to model their impacts on Venice, the lagoon and the North Adriatic coast. In order to deal with sustainability, interdisciplinary scientific research has had to model the system and its dynamics with an integrated approach, while major climatological processes and their evolution had to be understood and assessed.

The growing frequency and amplitude of storm surges have been the subject of several studies, but their short- and long-term prediction is still insufficient to operate an efficient defence system for the lagoon. There are thresholds beyond which the scientific analysis and modelling is still unable to be effective. These topics, at global and regional scales will be assessed by CLIVAR (Climate Variability and Predictability) an international programme.

Monitoring and predicting mean sea level rise is one of the new international projects of the decade under various international programmes such as WCRP (World Climate Research Programme) and IGBP (International Geosphere-Biosphere Programme). But there are other problems that Venice faces:

Subsidence, an irreversible process, has been less than 1mm per year in the last million years in Venice. It is a continuous process of tectonic nature.

Air pollution keeps increasing with the emissions from industries, human activities and urban development. In Venice the local impact comes from petrochemical industries and accelerates the ageing of brick and stones of monuments and dwellings.

Water pollution is a regional problem. The catchment basin of the Veneto is used to dispose of industrial and agricultural liquid pollution, which ends up in the lagoon and the northwest Adriatic. For regional administrations this is an economical and political problem difficult to solve without imposed regulations and sacrifice in the entire inland Venetian area.

The daily mass invasion from tourism consumes the city.

Conservation and restoration of monuments, palaces, dwellings, decorations and works of art as well as of the city waterways is a problem dealt with by the municipal organization, NGOs as well as private committees. It takes time and heavy financial commitments.

Ongoing Interventions

Regardless of long delays in decision policies for the larger preventive measures to save Venice from environment and human threats, several activities are underway to restore the city and the lagoon and prepare for its future. During the last two decades, a vast series of interventions was activated by the Department of Public Works of Italy to deal with shore and lagoon protection by means of nourishment, sediment fences, organic material, transplanting vegetation, dredging of tidal creeks and capping. The *Consorzio Venezia Nuova* has developed a sensible plan of morphological re-equilibrium to deal with erosion and accretion using the natural water dynamics (the soft principle of seconding nature) as much as possible.

In the past, the Venetian Republic had shown concern about sediment transported through river outlets into the lagoon. It diverted the Brenta and Sile rivers around the lagoon. In our time, because of the reinforced lagoon entrances dredged to allow large ship traffic, tidal currents and wind have increased the flushing power within the lagoon and risk transforming it into a bay system.

To protect Venice and populated centres from floods and the effects of extreme storm surges, mobile flood barriers were conceived in 1971 and their conceptual design completed in 1985. They are also designed to face a possible climatological global sea level rise of 50 cm above the present mean sea level and include locks to let large ships in or out of the lagoon when the gates are closed during storm surges. The advantage of this defence system is that it will be constructed and operated far from the city, on the three lagoon entrances. The gate system will protect the lagoon from tidal and storm surge waves when these exceed one metre above the standard level of reference.

We may have to face a new way of life if global change issues do not reverse their trend during this century - an unlikely possibility. Venice may have to live below sea level protected from the sea like the low areas of the Netherlands. Conflict

with the interests of oil companies and port authorities¹ may have to be strategically resolved at high governmental levels. Perhaps the dilemma is reduced to a choice: save Venice or save industry and economics. The challenge is how to meet both with proper ethical principles.

¹ The major users of the lagoon area.