A sinking feeling

For centuries, the city of Venice has lived in harmony with the waters that surround it. Indeed, the Venice Lagoon is symbolically and symbiotically interconnected with Venetian culture and history. However, as Jane da Mosto, Science Director at The Venice in Peril Fund has discovered, the impacts of climate change and sea-level rise are now threatening the harmony of that relationship. With the threat of rising waters and flooding now facing many of the world’s major cities, what lessons can we learn from Venice?

Looking at Venice while thinking of sustainability requires double-vision. It is probably the only city where people can look at paintings from centuries gone by in a museum and then find themselves standing in the same scenes (to quote a recent visitor)! The forms have hardly changed since medieval times; jumping through time, the views of Carpaccio, Canaletto or Turner are still identifiable today. So in architectural terms we can say that Venice was built in a remarkably sustainable way, in as much as many of the original features persist, as within Venice for some social-housing projects.

Working and living with water
The early Venetians were ingenious in their approach to creating Venice – amidst the mosquito-infested swamps, where they had been forced to take refuge from the invading barbarians – and they subsequently co-opted the natural dynamics of the lagoon system to create the collection of islands and canals that flourished for over a thousand years as the Republic of Venice and that remains today a site of exceptional natural beauty and artistic and cultural heritage. Over time, the Venetians consolidated the marshes and banked the channels to create the islands and canals of which the city itself is composed. This began in about the 10th century and continued until the mid 20th century when land was reclaimed from the lagoon around its perimeter for expansion of the airport and Marghera industrial zone, as well as within Venice for some social-housing projects.

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Innovative building techniques using horizontal timbers consist of wooden piles (2.3m long and 25-36cm wide) driven into the more stable layers of compressed mud. The poles do not decay since they are deep enough to never come into contact with air, which would make them susceptible to attack by microorganisms. The iconic church of Santa Maria della Salute, designed by Longhena in the 17th century, reputedly rests on over a million tie beams, that are often placed as causing the rusting of metal and via capillary rise reach as far above the impermeable stone bases of old buildings, as well as causing precious decorative plasterwork to fall off, fresco paintings to crumble and via capillary rise reach as far above the impermeable stone bases of old buildings. Wooden boards and then thick blocks of Istrian stone (a form of white marble from the opposite coast of the Adriatic) form the base of the buildings. The rest of the building is made of lighter materials notably brick and wood, which reduce the pressure of subsidence. Floors are typically a mixture of lime and clay with marble fragments, known as terrazzo veneziano. Beads milk was used as a sealant.

Venice in Peril supported a brilliant research project a few years ago, in collaboration with the Municipality of Venice, which demonstrated how the use of traditional building materials and techniques was more durable and equally cost effective than modern restoration methods. An abandoned vernacular building was beautifully transformed into three apartments including a ground-floor flat suitable for a self-sufficient disabled person.

Flooding – a feature of Venice life
So having praised Venice for its foresighted ‘structural’ resilience, it is now time to mention the other dimension: inevitable limits to its symbolic relationship with the lagoon, and water in particular. Being relatively impermeable to water, the stone bases of the buildings are a fundamental element of defence for Venice’s buildings from water infiltration – this is not only a problem of humidity but the saltiness of the lagoon water在一起 with the world/day cycles of the twice-daily tides in the lagoon, as well as periodic flooding, causes corrosion. Flooding has always been a feature of life in Venice. The earliest recorded occurrence was in the 13th century. The critical issue, from the point of view of urban maintenance, is the rising average water level, a combined result of natural, long-term geological subsidence (approximately 0.5mm/year), human-induced subsidence caused by groundwater extraction that compressed ground-level (more than 10cm between the 1950s and 1970s) and of course sea-level rise – not necessarily that associated with greenhouse-gas emissions and global warming, but also the significant variations produced by variations in atmospheric pressure, other weather conditions and major climate cycles.

Venice has been battling with the debilitating impacts of unusually creeping water levels that come into contact with building walls and permeate bricks and plaster, above the impermeable stone bases and via capillary rise reach as far as causing the rusting of metal tie beams, that are often placed at first-floor level to consolidate old buildings, as well as causing precious decorative plasterwork to fall off, fresco paintings to crumble and even the mosaics. In St Mark’s Basilica fall off its ceiling. The graph below shows the increased frequency of water levels at which saltwater infiltration of the fabric of Venice affects a large proportion of buildings – from an average of less than 100 times per decade at the end of the 19th century, chronic water levels are now experienced more than a hundred times in a single year.

Economic interests associated with petrochemical processing at Marghera (in decline since the latter part of last century and latterly intensification of activities at Venice’s commercial port and exponential growth in the cruise sector have intensified pressures on the lagoon by endorsing the necessity for deep navigation channels and ongoing dredging that exacerbate an existing trend towards erosion of the lagoon. Venice is at a critical point between its history and future. If present trends are allowed to continue, the distinguishing features that make Venice sustainable and resilient will be washed away by a reductionist economic structure and tourist floods that will preserve, at best, the building fabric in the form of some variant of a themepark. Venice in Peril firmly believes that a more viable future is possible for both the city and lagoon. For more than a decade we have been engaged in building and maintaining an independent platform for analysing and discussing the wealth of relevant scientific research in an objective and integrated framework to promote a process of long-term strategic planning and articulated thinking to plan the future for Venice that she deserves, and desperately needs. This work is not easy, but we carry on nonetheless, true to the Venetian expression: the apple grows as you eat.