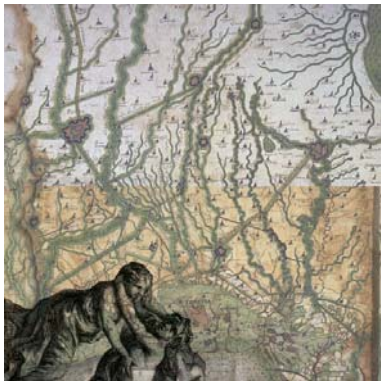
Venice's Lagoon should have vanished centuries ago, *silted by alpine sediments into* terra firma *or swept away by the tides of the Adriatic. Without careful management of its hydrological and geomorphological parameters—sediment influx from its rivers and the erosive influence of the sea—the landscape's dialectic is lost and the Lagoon will disappear. Venice's empire and identity were founded upon the management of this balance between water and land, tides and sedimentation.*

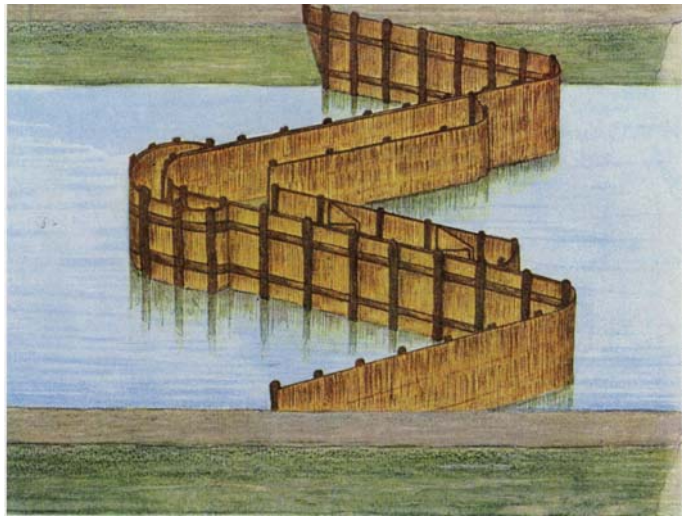
THE VENICE LAGOON AS A SERIES OF ENGINEERED ECOLOGICAL PARAMETERS

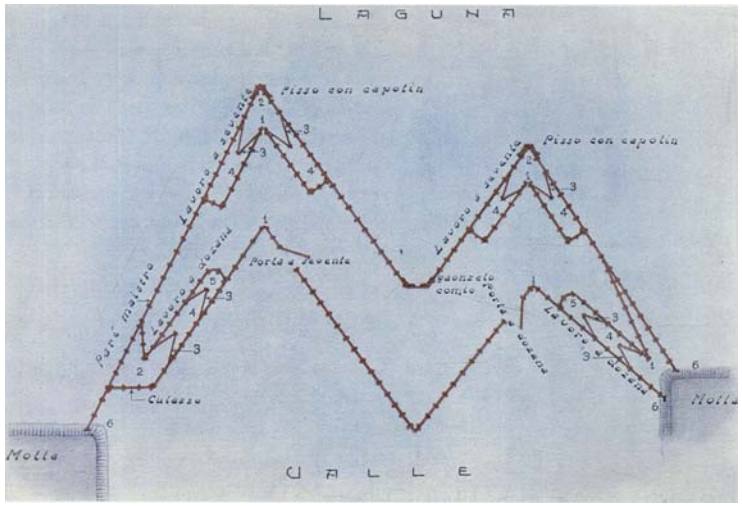


erosion (tides) and sedimentation (rivers)

large scale engineering (water management on terra firma*) and finer-grained adaptations (ephemeral infrastructures within the Lagoon)*

the Bora winds (alpine) and Sirocco winds (North African) magnify or diminish tidal currents





ephemeral infrastructures of the Venice Lagoon – wooden piles and fish mazes

Originally, the Lagoon's equilibrium was engineered through fine-grained, ephemeral infrastructures—*wooden piles and reed fishing mazes—a kit of resilient moving pieces that directed erosive currents or trapped sediments as they generated salt, fishing, and trade economies. During the Renaissance, the threat to the Lagoon by sedimentation from the rivers Brenta, Sile, Dese and Piave was addressed through the application of a rule-based system of 11 hydrological principles to the landscape.*

HYDROLOGICAL PRINCIPLES OF NICOLO ZEN (1557)

fresh water must be kept out of the lagoon

the sea is the lowest of all surface waters

Brondolo provides sea level

straight channels drain most efficiently

turbidity increases when flow slows

water levels rise when rivers meet

constant flow neither rises nor falls

rivers with no turbidity do not raise their beds or stretch the delta into the sea

embanking and canalizing improves flow

clear canals are more easily navigated than turbid canals

keep separate: large alpine rivers carrying sediment; local drainage canals carrying turbid runoff from hills and marshes; and clear-running streams running from the fontanile

RIVER DIVERSIONS AND IMPACT ON LAGOON MORPHOLOGY *highlighting introduction of Zen's principles, which are contemporary with diversion of Brenta from Southern Lagoon*

RIVER DIVERSION_ 1300

numerous rivers, including the Brenta, Bacchiglione, Sile, and Piave, empty into the lagoon

RIVER DIVERSION_ 1400

operations, not to be completed until the 16th c., begin to divert the mouth of the Brenta, which is understood to be the primary cause of silting in the lagoon

RIVER DIVERSION_ 1500

Cristoforo Sabandino (hydrologic engineer) argues that rivers are primary source of silting in lagoon and that all should be diverted, beginning centuries worth of large-scale works

RIVER DIVERSION_ END OF 1500

dredging of Santo Spirito channel begins; barrier constructed to stop flow of Brenta and Bacchiglione into the lagoon of Chioggia

RIVER DIVERSION_ 1600

Novissimo river is cut connects Mira and Port at Brondolo, cut supplies former Brenta riverbed with enough water for navigation

RIVER DIVERSION_ END OF 1600

Sile cut made, directing Sile river through old riverbed of the Piave

RIVER DIVERSION_ 1700

murazzi (sea wall defence) constructed

RIVER DIVERSION_ 1800

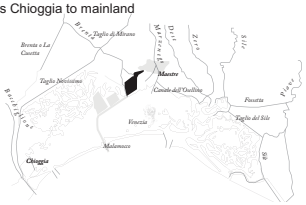
translagoon railway bridge, commercial port, jetties at Malamocco

RIVER DIVERSION_ 1900

construction of outer jetties (and current inlet structures) at Lido, first industrial area at Marghera built, car access over bridge, fish farms in north and south lagoon

RIVER DIVERSION_ END OF 1900

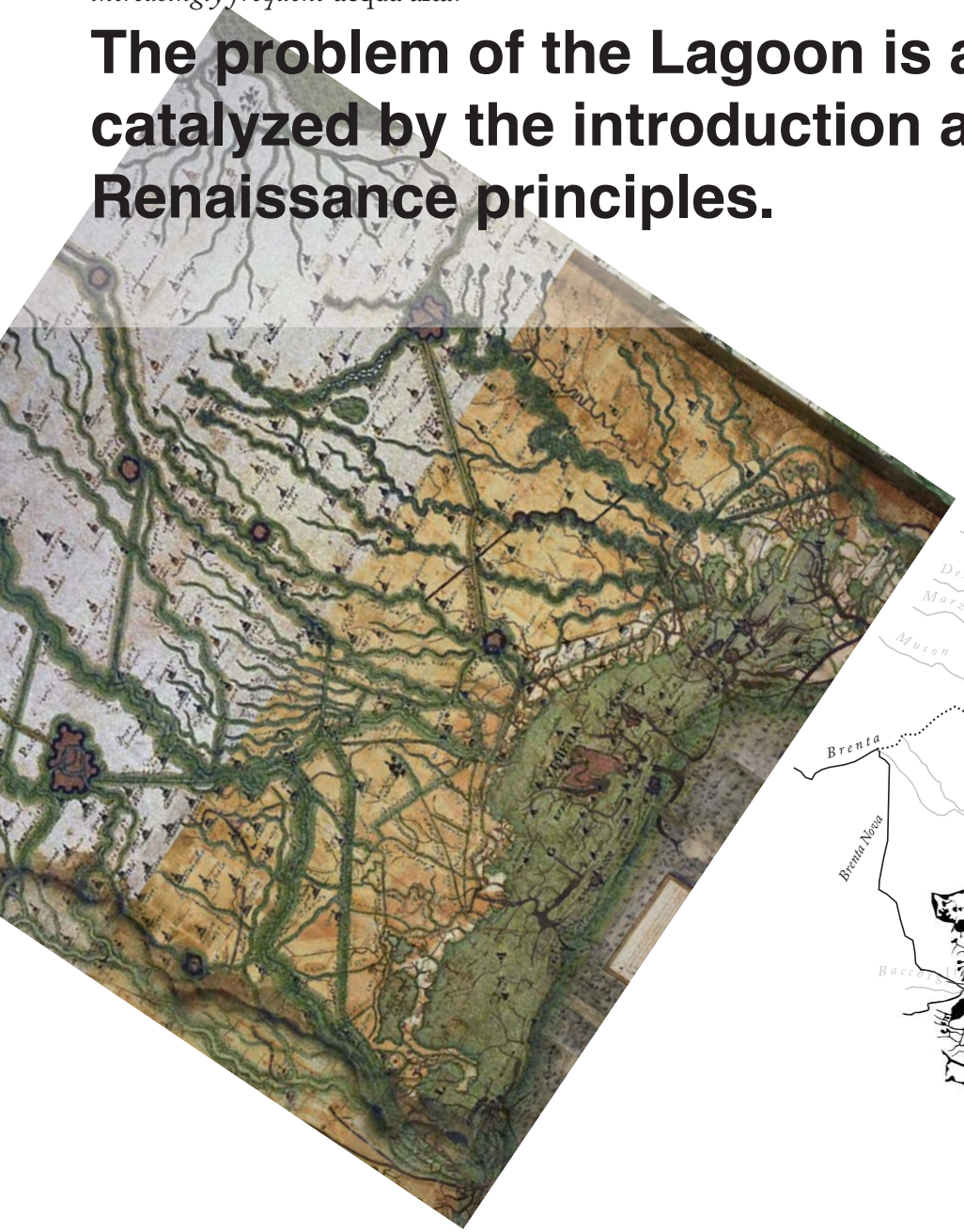
reclamation of areas of lagoon, large channel (the Oil Tanker Channel) dredged between Marghera and Malamocco inlet, airport built on reclaimed Teserra marsh, translagoon bridge connects Chioggia to mainland



These ruled played out at various scale—major rivers were re-routed and drainage patterns were geometrized across terra firma. **Through the application of this logic to the landscape, the balance between sediment and water within the Lagoon was disrupted—with the deprivation of its sediment, the Lagoon's dialectic was lost: the city began to slowly sink.**

Six centuries later, the effects of the Lagoon's sediment loss and erosion are felt within the city—the Lagoon's deepening bathymetry and exaggerated tidal channels cause increasingly frequent acqua alta.

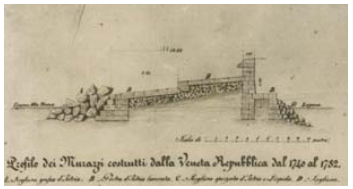
The problem of the Lagoon is a problem of sediment deprivation, catalyzed by the introduction and accreted effect over time of 11 Renaissance principles.

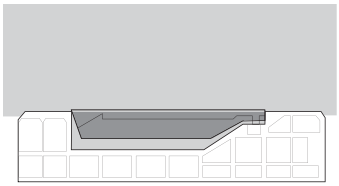


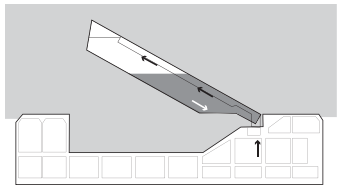
Overlaid maps of Lagoon and its changing context -- re-geometrized terra firma *(1556)*

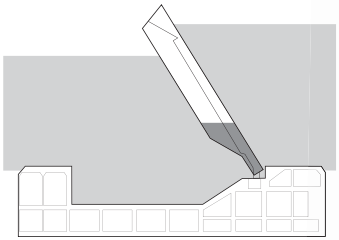
Lagoon morphology at moment of Brenta's diversion

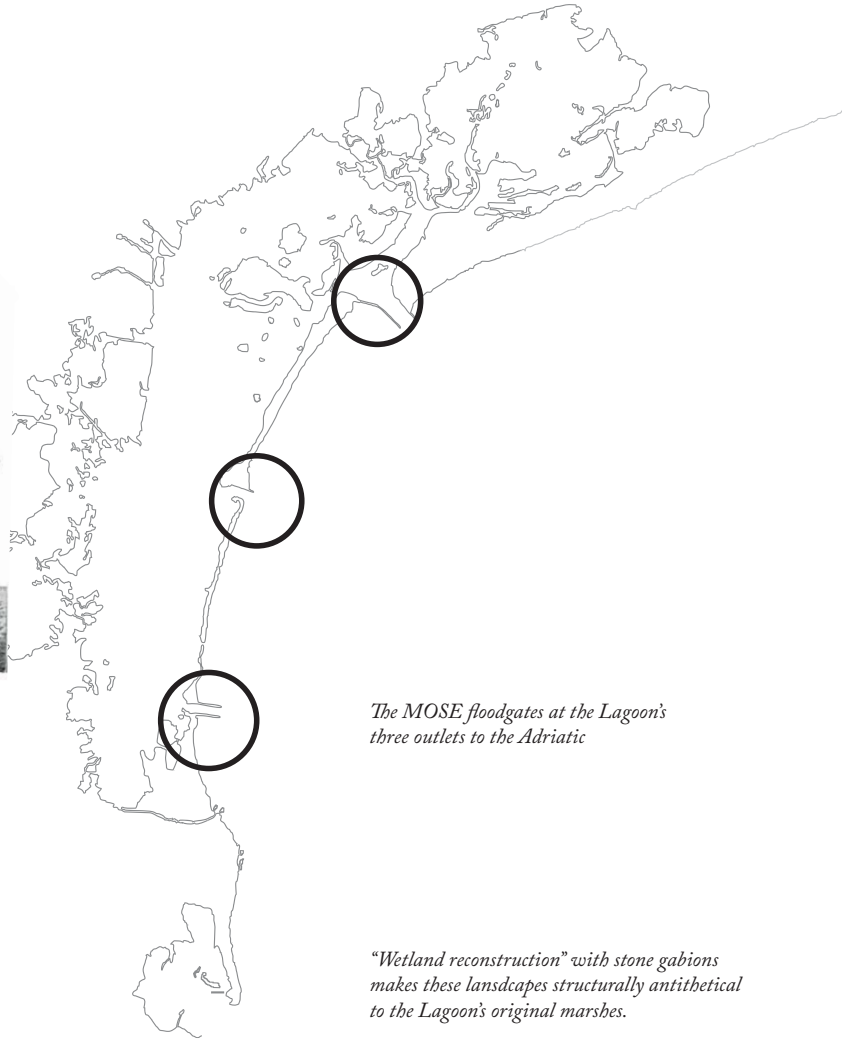
Contemporary, deteriorating morphology fo the Lagoon











EVOLUTION: MURAZZI to MOSE *Morphological shift due to sediment loss in the Lagoon results in calcification as defense strategy, ultimately articulated in the hydraulic MOSE floodgates, which, despite an attempt to complete the ultimate line of defense from the Adriatic's rising tides, are structurally flexible, with the ability to influence the tide and engineer, potentially, equilibrium within the Lagoon.*

The MOSE floodgates at the Lagoon's three outlets to the Adriatic

"Wetland reconstruction" with stone gabions makes these lansdcapes structurally antithetical to the Lagoon's original marshes.

But the solution has, for centuries, been one of a calcified edge—*the hardening of seawalls, taking the form of the Lagoon's rising* murazzi *and, ultimately, the MOSE floodgates, which signify an attempt at absolute control over the effects of the tide. Current strategies for rebuilding the Lagoon at a smaller scale, in their form and materiality, further the calcification process.*

An equilibrium would require the reintroduction of sediments, or a reversal of the hydrological logic of the Renaissance, *and the process of sedimentation can be accelerated through the reintroduction of small, adaptive, ephemeral structures (vs. hard, permant "rebuilding" structures like the gabions) that catch and guide sediment, assisting wetland rebuilding processes.*

NEW HYDROLOGICAL PRINCIPLES FOR THE VENICE LAGOON

building

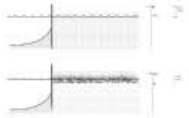
"a wooden pile builds a marsh"

a lagoon is defined by a relationship of optimal balance

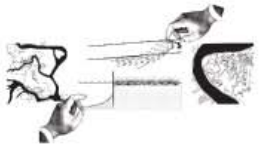
elevation defines a salt marsh

barene require high area/ perimeter ratio

dendridic forms are regenerative; linear forms are destructive



land accretes gradually, with the tide



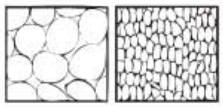
modification of tidal and sedimentary paramters accelerates rebuilding processes

materials

materials introduced to the lagoon should be adaptive/ flexible/removable

infrastructures are modular/ redunant/soft

geotextiles are economically sustainable



silt, not sand

materials introduced to the lagoon should biodegrade

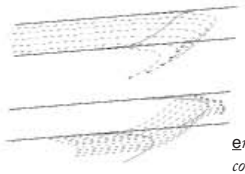
a mosaic of sediment types results in the formation of complex ground patterns

rigid materials accelerate degradation of the lagoon

flows

laminar flows build, turbid flows disturb

channelization vs. delta formation

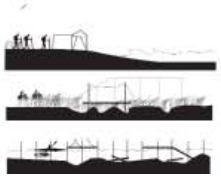


erosion and deposition create similar concave forms

interfaces

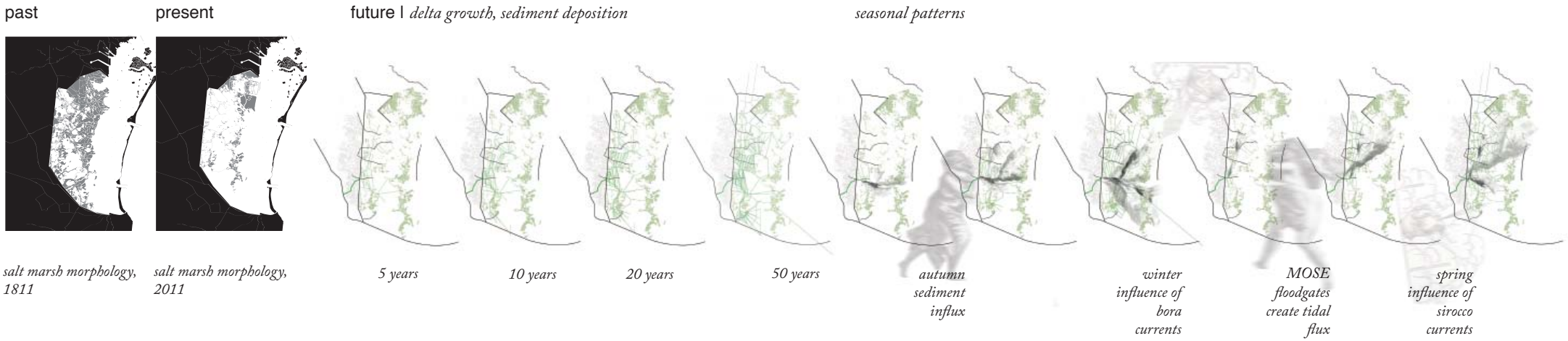
economy + ecology

tourist economy + ecology



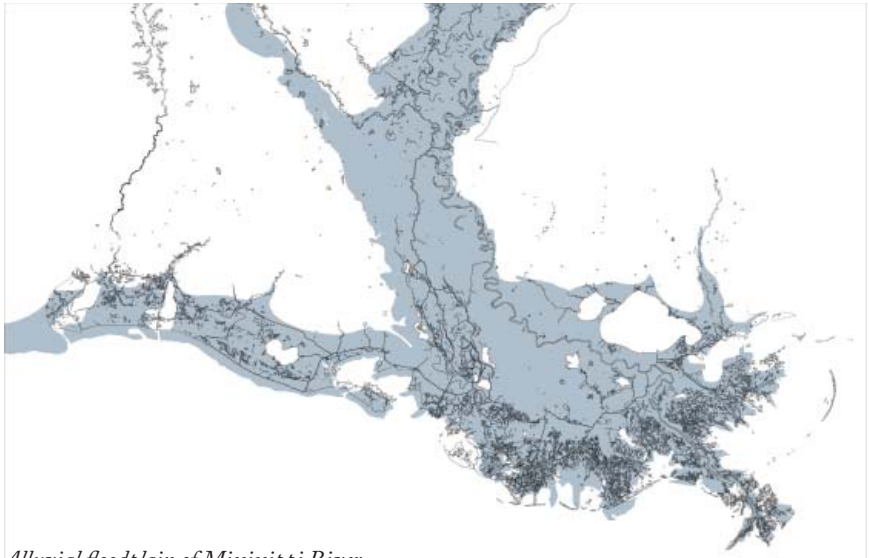
tourist economy + ecological regeneration

REBUILDING THE SOUTHERN LAGOON: *reintroducing sediments from the Brenta and modulating the tides with the MOSE floodgates*

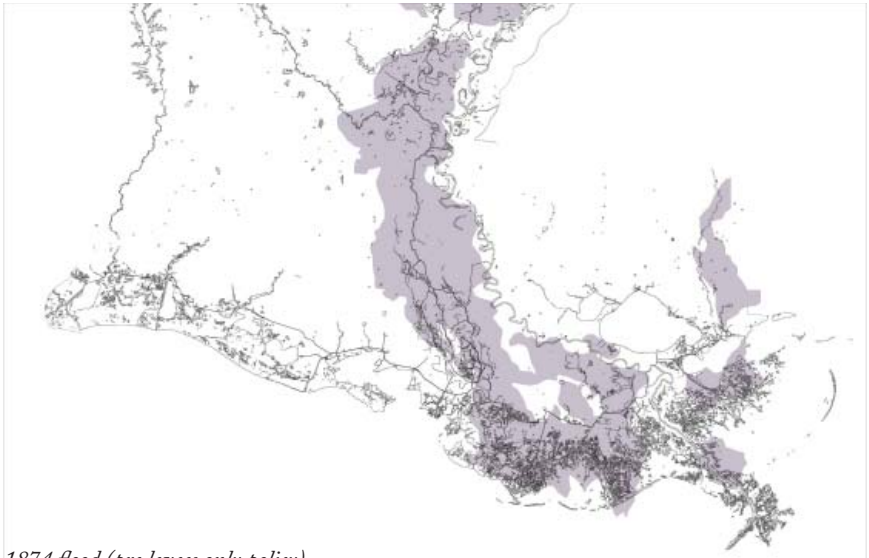


To reintroduce sediments to the Lagoon, a rediversion of the Brenta River--through its original course and into different parts of the southern Lagoon through smaller diversions--is proposed. The diversions are fluctuated to strategically distribute sediment throughout the southern Lagoon, mimicking the shifting fan of the river deltas that originally formed the Lagoon's ground. The timing of these fluctuations is synchronized with the seasonal water and sediment levels of the Brenta and with the currents caused by seasonal winds, the Bora and Sirocco, which steer and accelerate sediment deposition. The MOSE floodgates, despite their symbolic function as the ultimate iteration of the murazzi, also have an ability to engineer the tidal conditions of the Lagoon. The MOSE is, therefore, used in concert with the fluctuated Brenta diversions to create optimal tidal conditions and increase the potential of the wind as a vector (influence of wind overriding influence of tide when the floodgates are closed).

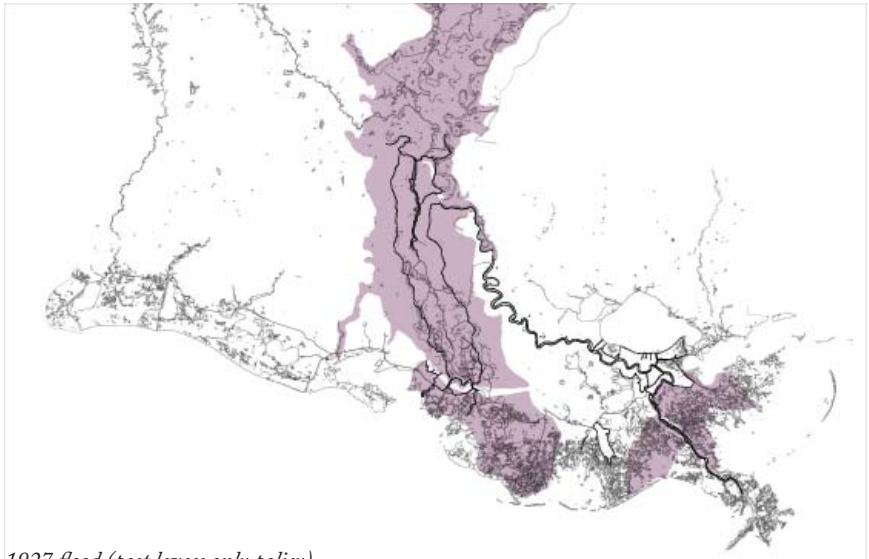
The MOSE gates and Renaissance river diversions, symbolic of environmental stagnation, are now made flexible and, together, they can form a complete landscape machine, capable of striking ideal relationships between the opposing forces of sedimentation and tides that define the lagoon as a dialectical landscape.



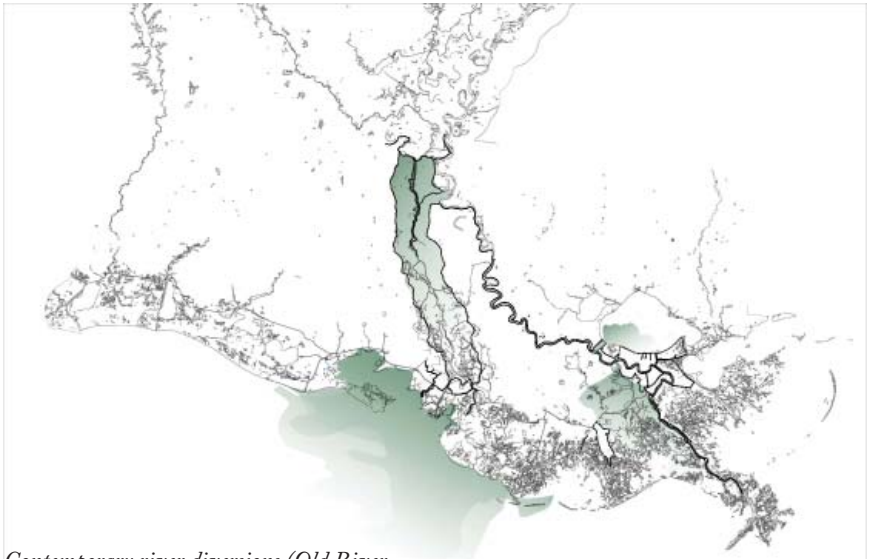
Alluvial floodplain of Mississippi River



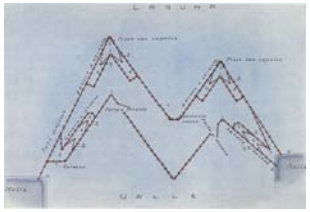
1874 flood (pre levees only policy)

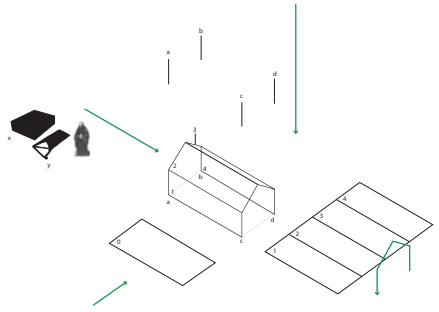


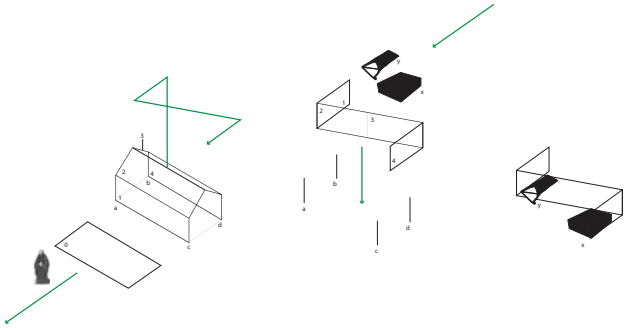
1927 flood (post levees only policy)

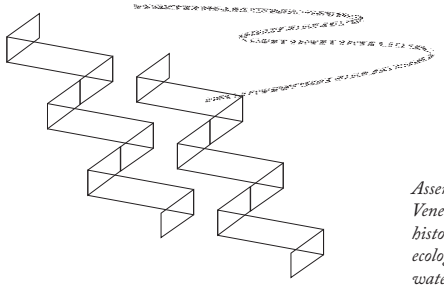


Contemporary river diversions (Old River Control Structure/Atchafalaya Basin, Davis Pond Freshwater Diversion, Bonnet Carre Spillway)









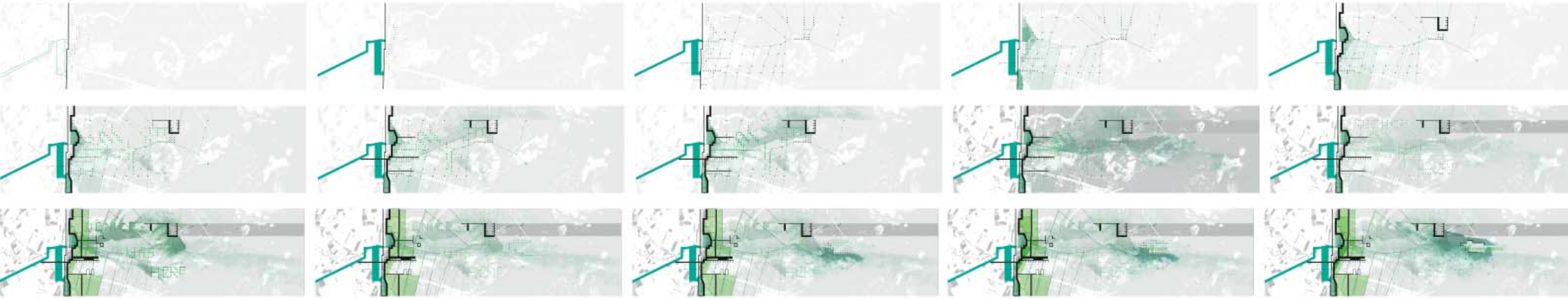
a/b/c/d wooden piles [anchor camping platform]
1/2/3/4 biodegradable tent panels
0 camping platform
x geotextile mattress
y geotextile sleeping bag

Assembly process as camping reflects historic Venetian urbanisms; disassembly reflects historic infrastructure of fine-grained, ecologically attuned ground-building and water-directing infrastructures; abandoned campgrounds accelerate salt marsh regeneration-- complex, rule-based, emergent forms intercept sediments.

The first Venetians were amphibious, creating land out of shifting water and ground—their logic and techniques are here reinterpreted.

At a small scale, a series of ephemeral infrastructures can refract (intensify or dissipate) the effects of the Lagoon's modulated parameters

while, additionally, regenerating historic Venetian urbanisms and channeling the tourist "tide" as a productive, vs. degrading, force. Following a pre-Renaissance logic, a kit of small, redundant components (biodegradable materials designed as ephemeral infrastructures—similar the Lagoon's original fishing mazes and wooden piles) is used to direct sediments and currents, accelerating regenerative landscape processes within the Lagoon. Because it is too expensive for most tourists to inhabit Venice, these components take the form of a camping kit—a series of piles (stakes for anchoring a boat or pitching a tent) and geotextiles (biodegradable sleeping bags, mattresses and tent materials)—and a manual (set of rules). The camping site and its patterns change with the seasonal dynamics of the Lagoon and in anticipation of the Brenta's sediment influx, but the kit and rules remain consistent; complexity arises out of a basic set of principles and materials that reacts to the Lagoon's changing parameters. This is the opposite of "leave no trace behind" camping—the kit of camping parts is purchased by tourists and the tourists rebuild the Lagoon by camping and leaving their camping materials to help build ground. In this way, the nature of Venice's tourism becomes a constructive, vs. degrading, environmental parameter.



ephemeral infrastures anticipate sediment influex and accelerate accretion

LAGOON AS LANDSCAPE MACHINE IN DIALOGUE WITH AN EMERGENT PATTERN OF EPHEMERAL LAND-REBUILDING STRUCTURES *large scale engineering of river diversions and tides are influenced by finer grained, adaptive kit of parts, accelerating the accretion of sediments and regeneration of wetlands*

accelerated saltmarsh succession