

STUDYING THE EVOLUTION OF THE LANDSCAPE IN THE ROMAGNA COASTAL ZONE (NORTHERN ITALY). THE CONTRIBUTION OF HISTORICAL CARTOGRAPHY

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ABSTRACT

This article focuses its attention on the key-role of historical cartography in the study of landscape evolution and man-environment interactions, in particular in the framework of fast evolutionary and natural/man-induced processes sensitive areas, such as sandy coastal systems. In the case-study of the Romagna Coastline (Northern Italy), facing the Adriatic Sea, a step-by-step reconstruction of littoral trends during the last four centuries has been possible thanks to historical maps. On the basis of these visual sources, the progressive transition from a coastal zone under sedimentation to the present-day one under erosion is recognizable. Other landscape-related themes visible on the maps are coastal woods deforestation and large land-reclamation programs aimed at creating new lands for agriculture and mitigate the demographic growth according to a malthusian view of problems.

Key words: Romagna coastal zone, landscape evolution, coastline evolution, historical cartography

LO STUDIO DELL'EVOLUZIONE DEL PAESAGGIO NELLA COSTA ROMAGNOLA (ITALIA SETTENTRIONALE). IL CONTRIBUTO DELLA CARTOGRAFIA STORICA

SINTESI

L'articolo focalizza la propria attenzione sul ruolo chiave rivestito dalla cartografia storica nello studio dell'evoluzione del paesaggio e dei rapporti uomo-ambiente, in particolare nell'ambito di aree a rapida evoluzione e fortemente reattive a processi naturali o indotti dall'uomo, come i sistemi costieri sabbiosi. Nel caso della costa romagnola (Italia settentrionale), affacciata sul mare Adriatico, grazie alla cartografia storica è stata possibile una ricostruzione delle dinamiche dei litorali negli ultimi quattro secoli. Tali fonti visive permettono infatti di riconoscere la progressiva transizione da una zona costiera soggetta a sedimentazione alla situazione odierna caratterizzata dall'erosione. Il taglio dei boschi litoranei e i grandi interventi di bonifica sono altri temi legati al paesaggio desumibili dalle mappe, connessi allo scopo di creare nuove terre per l'agricoltura e di mitigare, in una visione malthusiana del problema, l'incremento demografico.

Parole chiave: costa romagnola, evoluzione del paesaggio, evoluzione della costa, cartografia storica

INTRODUCTION

Romagna (fig. 1) represents the southern part of the Emilia-Romagna Region (in northern Italy, it is a region made up of Bologna (in part), Ravenna, Forlì-Cesena and Rimini Provinces), being circumscribed to the west by the Apennines chain and facing eastward to the Adriatic sea. This sub-region, with a surface of approx. 6500 km² (Gambi, 1950), is located on a transition latitude between the Mediterranean bio-geographical area to the south and the continental area, here constituted by the Po plain, to the north (Cencini, 1996).

Differing from eastern Adriatic shorelines, the Romagna Coastal Zone is characterized by very straight and regular sandy beaches (130 km in length), partially due to the alluvia of the prehistoric and historical configurations or the Po river, the largest Italian watercourse (hydrographical basin surface: 70,000 km²; approx. 4 millions m³/year of solid transport). This coastline is considered a Quaternary coastal area due to sedimentation processes, while *rias*, cliffs or rocky coastal landforms connected to Holocene marine transgression are absent.

Thanks to this geomorphology and to the large availability of land and beaches, »Sun & Sea« tourism grew

almost year by year mostly during the 20th century, changing the Romagna Coastal Zone into a tourism-based economy region (Campi, Menegatti, 1995). Unfortunately, with such high human impact influenced by a neo-classical view of economic growth caused speculative urbanization processes and a decrease of the quality of water and the ecology in the region (for example, in particular during the '80s where marine waters underwent eutrophication: Curzi, Tombolini, 1989). From the '50s to the '80s only a few programs were in place to mitigate anthropogenic impact on Romagna coastal system; the institution of the Emilia-Romagna Po Delta Regional Park, founded in 1988, occurred very late, when most of the natural values had already been lost.

This article, skipping current issues and problems related to coastal systems management and sustainable development, will deal with the historical evolution of the landscape of the area, analysing in a chronological perspective trends and patterns and using historical cartography as the main source for such an approach.

Final consideration will be given to comparing old maps with the contemporary situation.

THE EVOLUTION OF THE ROMAGNA COASTLINE THROUGHOUT THE CENTURIES. TRENDS, THEMES, STUDY SOURCES

Similar to other sectors of the western Upper Adriatic shores, several factors both natural and man-made play an important role in modelling the Romagna coastal landscape (Ciabatti, Veggiani, 1990).

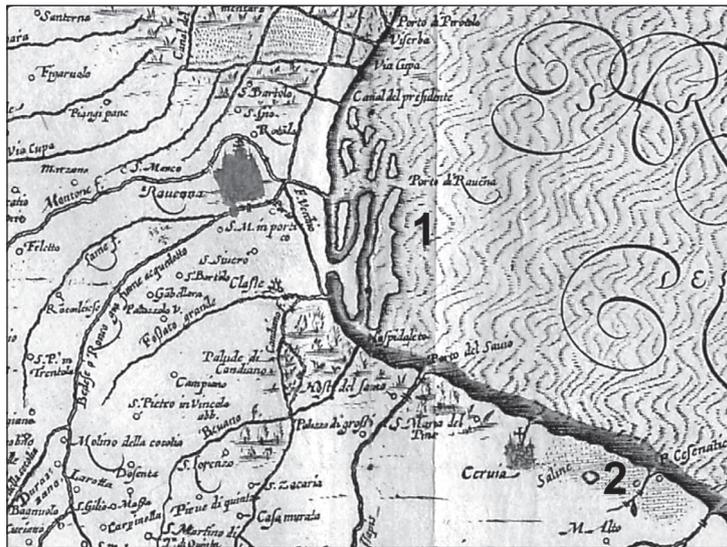
Concerning the natural factors, the first one has to be identified in the relationship between sediments brought to the sea by watercourses and their distribution and transport made by waves and marine streams. In the case that alluvia could not be dispelled by marine action, a littoral progression will be in action (this is the natural trend); instead, a decrease in solid transport via watercourses usually related to anthropogenic factors will produce coastal erosion because sediments will be not enough to warrant beach nourishment. In the case of the Romagna region, the balance between sediments and waves must be considered a delicate one: in fact, the rivers of Romagna show irregular regimes and a low solid transport, due to large clay outcrops and small rocky ones in the framework of their hydrographical basin; a solid transport alteration can endanger such a balance.

A second landscape-related factor is wind, which drives the waves and models sand dunes. In particular, dunes are located following coastal sedimentation, in parallel-to-the-coastline stripes in a chronological order from inland to the seafont. Currently, anthropogenic works activity has altered the littoral physiognomy and erased sand dunes (Cencini, 1980). The impact of winds on the Romagna coastal landscape is negligible.



Fig. 1: Location of the study area: the grey line circumscribes the Romagna Region (northern Italy), facing the Adriatic Sea.

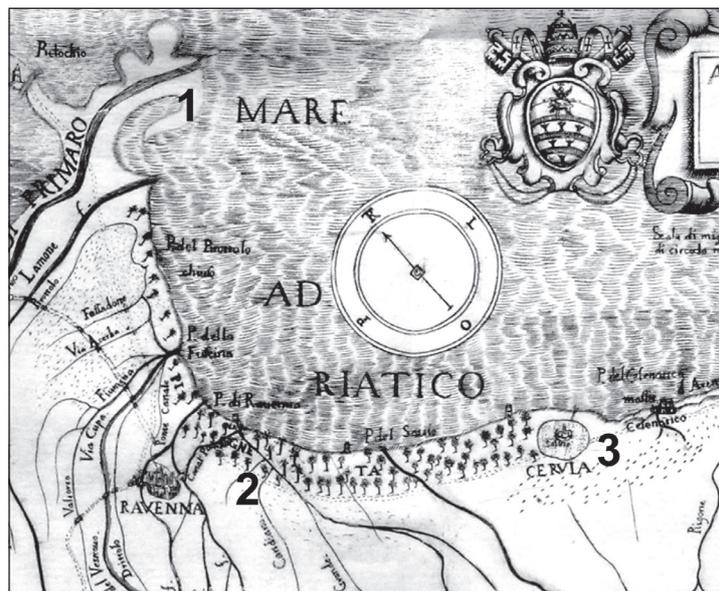
Sl. 1: Lokacija obravnavanega območja: siva črta zarišuje deželno Romagno (severna Italija) ob Jadranskem morju.



Legend: North is on the top. Sector between Ravenna and Cesenatico: 1 – Sedimentation processes east of Ravenna; 2 – Cervia and Cesenatico salt pans.

Fig. 2: Section of Romagna olim Flaminia by Giovanni Antonio Magini, 2nd edition dating to 1598 (Biblioteca comunale di Forlì, Raccolte Piancastelli, Sez. Stampe e Disegni, Album Topografia »Toscana Polesine Stato Pontificio« (I), f. 19, Cass. 20; Authorisation no. PG 93207/10).

Sl. 2: Del zemljevida Romagna olim Flaminia Giovannija Antonia Maginija, druga izdaja iz leta 1598 (Biblioteca comunale di Forlì, Raccolte Piancastelli, Sez. Stampe e Disegni, Album Topografia »Toscana Polesine Stato Pontificio« (I), f. 19, Cass. 20; Dovoljenje št. PG 93207/10).



Legend: North is on the top, but diverted to the left by 44 degrees. 1 – The Po di Primaro river mouth, extending towards the Adriatic Sea; 2 – Ravenna pinewoods; 3 – Cervia salt pans.

Because of its shape, in written and cartographical sources dating to the 16th–17th centuries part of the Po di Primaro mouth complex is frequently indicated as »Testa d’asino« (literally, »Donkey’s head«).

Fig. 3: Section of Aque, Fiumi, e Scoli principali della Romagna by Pietro Maria Cavina (1678) (Piastra, 2009).

Sl. 3: Del zemljevida Aque, Fiumi, e Scoli principali della Romagna, katerega avtor je Pietro Maria Cavina (1678) (Piastra, 2009).



Legend: North is on the right. 1 – The original Fiumi Uniti river mouth; 2 – Artificial diversion to the south, completed in 1739, in order to prevent floods in the city of Ravenna during the so-called »Little Ice Age«.

Fig. 4: Section of the map attached to Raggiungimento storico della diversione dei due fiumi il Ronco ed il Montone della città di Ravenna by F. D. Bellardi (1741) (Biblioteca comunale di Forlì, Raccolte Piancastelli, Sez. Stampe e Disegni, Album Topografia »Toscana Polesine Stato Pontificio« (I), f. 15/11, Cass. 20; Authorisation no. PG. 93207/10). Sl. 4: Del zemljevidu, priloženega delu Raggiungimento storico della diversione dei due fiumi il Ronco ed il Montone della città di Ravenna, avtorja F. D. Bellardija (1741) (Biblioteca comunale di Forlì, Raccolte Piancastelli, Sez. Stampe e Disegni, Album Topografia »Toscana Polesine Stato Pontificio« (I), f. 15/11, Cass. 20; Dovoljenje št. PG. 93207/10).

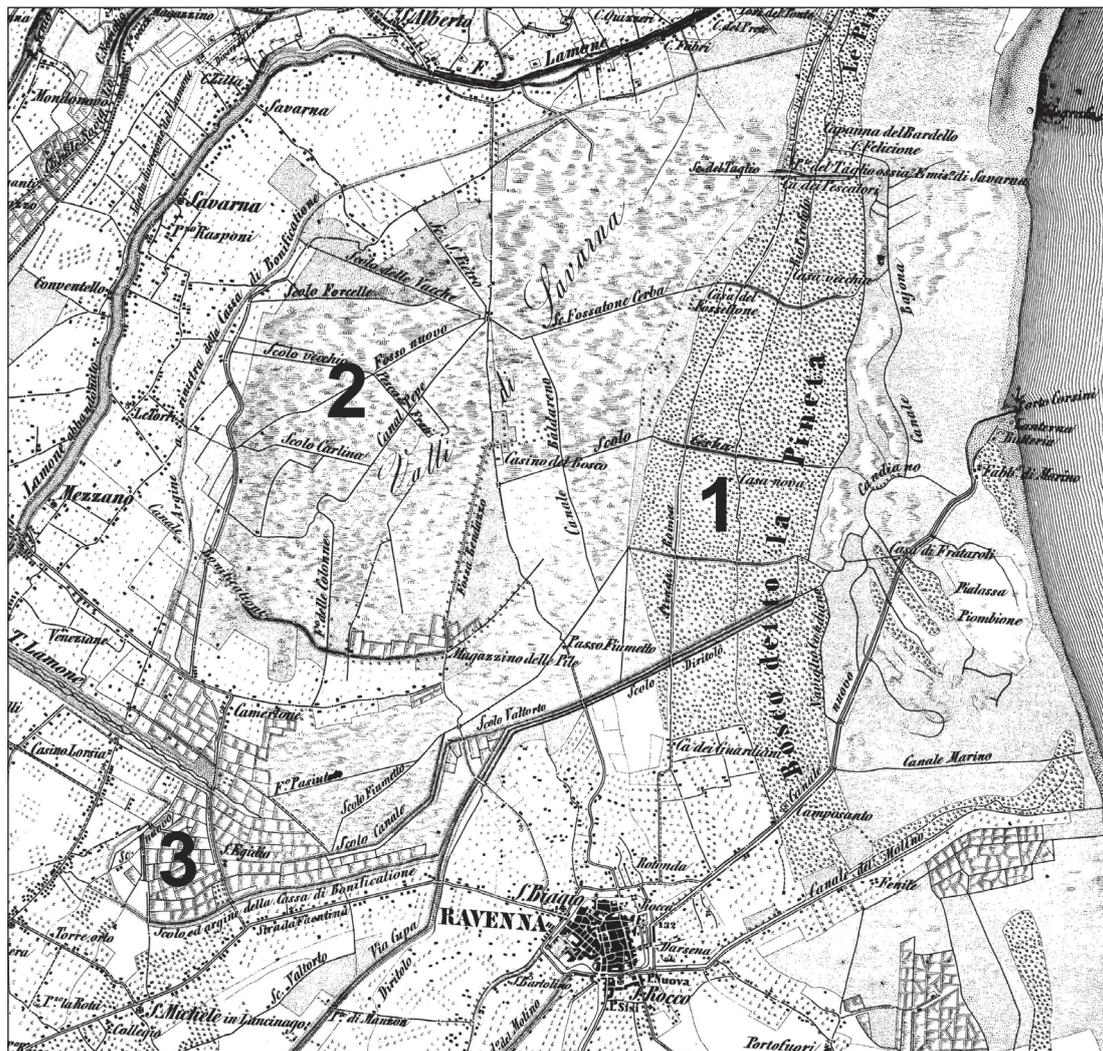
A further geomorphological element in action is subsidence: in the last decades there has been an increase in its progression because of inland or off-shore drillings for waters or natural gas, which emptied underground deposits and induced a sinking; a subsidence aggravation could bring to submersions and marine waters ingressions.

Moreover, in the future, eustatism could be a further landscape-modelling agent here: global warming-related marine transgression could, in a short time, cause a significant coastal withdrawal (Gabbianelli, 2007).

Instead, tides, different from oceanic littorals, but similar to the Mediterranean, play a negligible role in the dynamics of the Adriatic Sea.

Regarding human factors, in the last 150 years man has altered the régime of the watercourses. A significant intervention must be identified in hydraulic land-reclamation: wetlands and lowlands, located in depressions

below the sea level, have been filled-up thanks to river alluvia, conveyed there on the basis of anthropogenic river diversions. Such a system requires just a few projects (fluvial diversions; construction of banks to canalize the sediments; etc.), but it runs only over a very long period (decades, sometimes centuries, depending on the solid transport of the rivers). This approach was frequently used during medieval and modern times in the Po Plain in general and in the Po Delta in particular, until the beginning of the 19th century; the most important hydraulic land-reclamation project in the Romagna Region was the »Lamone land-reclamation« in the Ravenna district (7000 hectares; 1840-1950 approx.). But »the reverse of the medal« of hydraulic land-reclamations consists in the fact that the sediments used to reclaim here are withdrawn to the natural nourishment of the beaches.



Legend: North is on the top. 1 – Residual pinewoods; 2 – Coastal wetlands; 3 – Reclaimed areas. In comparison with previous maps (fig. 3), Ravenna pinewoods have undergone a drastic reduction in surface.

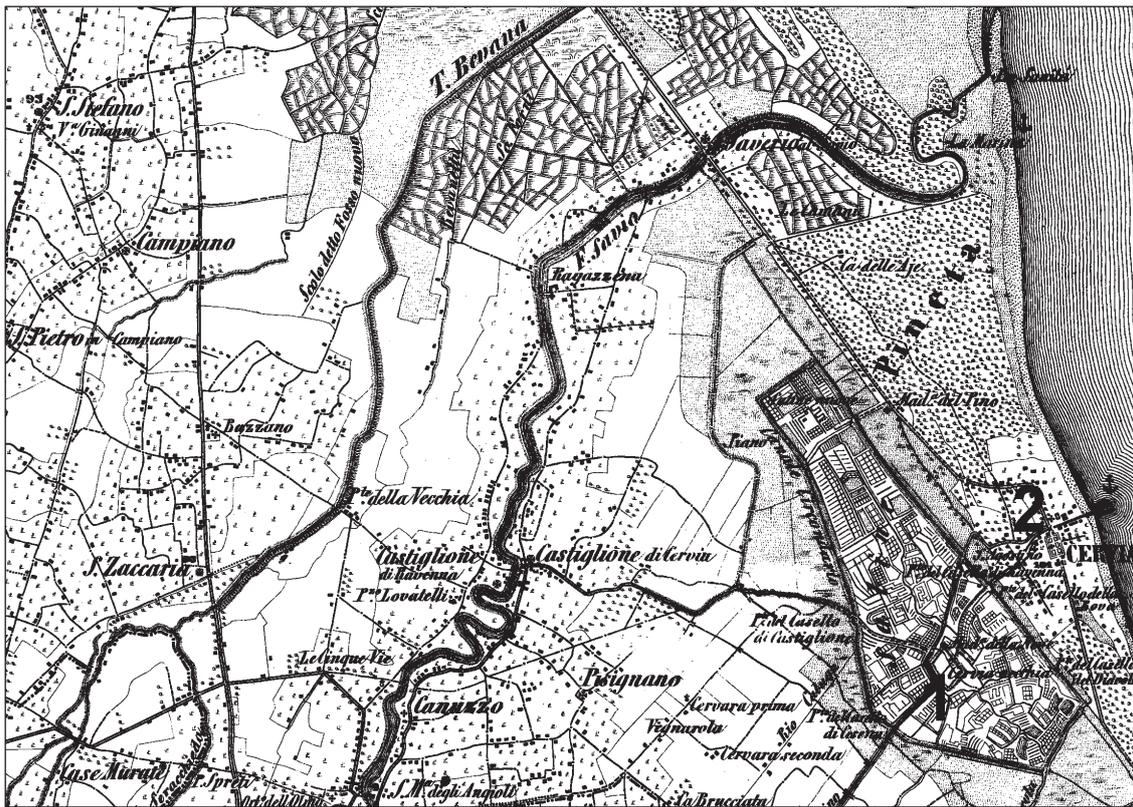
Fig. 5: Section of *Carta Topografica dello Stato Pontificio e del Granducato di Toscana*, drafted by the Austrian Imperial Army Geographical Institute (1851), Scale 1:86,400. (*Carta storica regionale (Regional historical map)*, image use authorised by the Emilia-Romagna Region).

Sl. 5: *Del zemljevida Carta Topografica dello Stato Pontificio e del Granducato di Toscana*, ki ga je pripravil Geografski inštitut avstrijske cesarske vojske (1851), merilo 1:86.400 (*Carta storica regionale (Območni zgodovinski zemljevid)*, objavljen z dovoljenjem dežele Emilie-Romagne).

Other human alterations in the régime of watercourses are the constructions of dams both for irrigation and hydropower: similar to hydraulic land-reclamations, dams stop solid river transport and do not allow the sediments to reach the sea.

Further human impact on coastlines, in particular that of the last century, is connected to the construction of new ports (moles can stop marine sands transport along the shorelines) and to shingle quarries, which could decrease river solid transport and slow beach nourishment.

In conclusion, the reciprocal influence and action of these factors on sandy beaches like those of Romagna produces fast and large-scaled geomorphological processes more greatly than in rocky coastlines; sedimentation and erosion alternated through the centuries, both for natural and anthropogenic reasons, however, if in the more distant past natural factors were predominant, human impact has become more and more relevant starting from the second half of the 19th century, in particular after the second Industrial Revolution. Nowadays, in the Romagna Coastal Zone, man must be considered the main geomorphological agent.



Legend: 1 – »Cervia vecchia«: the original location of Cervia, surrounded by salt pans; 2 – »Cervia«: the re-foundation site facing the Adriatic Sea.

Fig. 6: Section of *Carta Topografica dello Stato Pontificio e del Granducato di Toscana (1851)* (*Carta storica regionale (Regional historical map)*), image use authorised by the Emilia-Romagna Region.

Sl. 6: Del zemljevid *Carta Topografica dello Stato Pontificio e del Granducato di Toscana (1851)* (*Carta storica regionale (Območni zgodovinski zemljevid)*), objavljen z dovoljenjem dežele Emilie-Romagne).

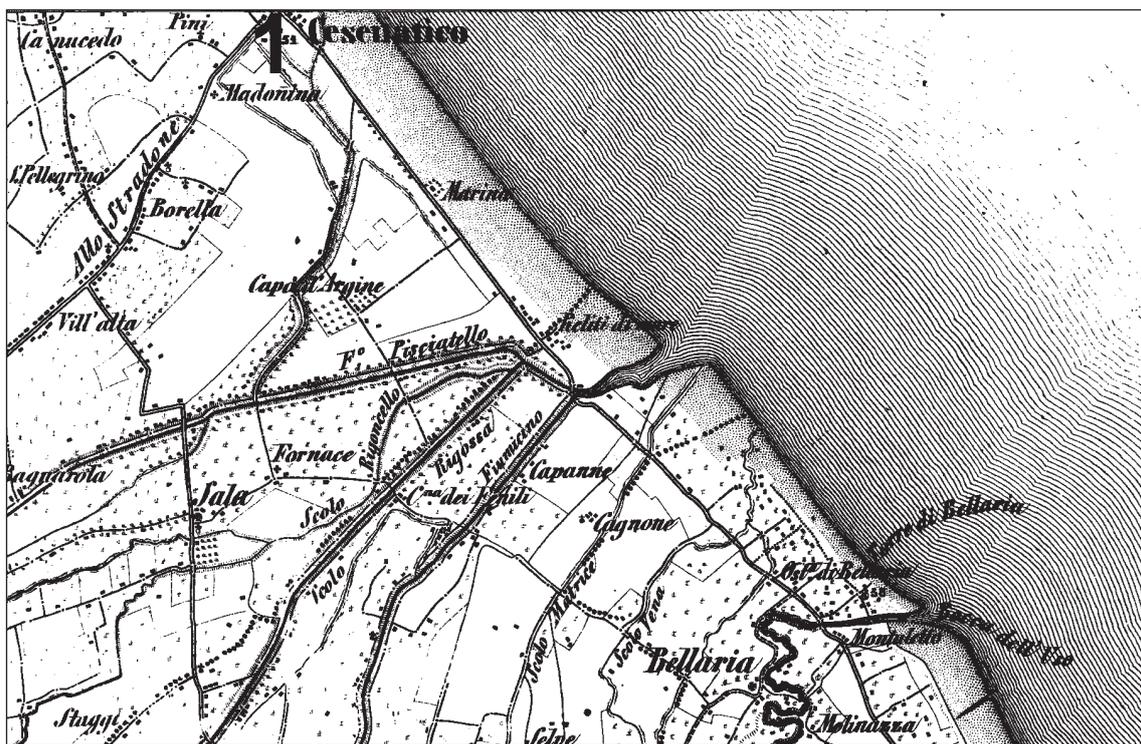
Thanks to historical maps, a medium-resolution reconstruction of littoral trends is possible, but only starting from the late 16th century. In fact, previous late-medieval or early modern age maps are unscientific, more similar to drawings than to geometrical representations without any scale or legend and are characterized by a stereotyped symbolism. Moreover, printed cartographical representations are available for this region only starting from the end of the 16th century.

16TH CENTURY CARTOGRAPHY

The oldest representation useful to this study is *Flaminia* (Latin name, as well as *Romània*, of Romagna), drafted by Egnazio Danti (1536–1586), professor at the University of Bologna between 1580 and 1582 under Pope Gregorius XIII (Gambi, Pinelli, 1994). It is something more than just a map: it is a colour fresco on the walls of the Gallery of Maps in the Vatican in Rome, being a part of a cycle representing the whole of the Pope's possessions; besides artistic and scientific aims, ideological and celebrative purposes are also present in the map. *Flaminia* has to be considered a masterpiece, being the first

large-scaled scientific representation of the Romagna Region, at that time under the Pope's rule; it is also important because it underlines main territorial vocations. On the map, north is on the top, but diverted to the left by 44 degrees, while the scale is about 1:27,500.

A sector of *Flaminia* represents the coastline north of Ravenna. From the Adriatic Sea towards the inland, three »belts« are visible: sandy beaches, pine-woods and wetlands. Sandy beaches are related, as previously discussed, to river sedimentation while pine-woods here date to the Medieval Age: it is an artificial forest mainly composed of stone pines (*Pinus pinea*) which monks from Ravenna seeded in order to fix old dunes and to provide timber for building and heating as well as resins for pharmacopeia (Fabbri, Missiroli, 1998). In Danti's *Flaminia*, pine-woods are depicted in their original surface, without any interruption between the mouth of the Po di Primaro river to the north (a senescent arm of Po river, currently renamed Reno river) and Cervia to the south. Wetlands, in this region known as »valli«, (sing. »valle«, from the Latin word »vallum«: wall, in this case a dune-bar) are located in depressions below the sea level, due to subsidence phenomenon.



Legend: 1 – Cesenatico salt pans have been converted to new agrarian fields, because unprofitable.

Fig. 7: Section of Carta Topografica dello Stato Pontificio e del Granducato di Toscana (1851) (Carta storica regionale (Regional historical map), image use authorised by the Emilia-Romagna Region).

Sl. 7: Del zemljevid Carta Topografica dello Stato Pontificio e del Granducato di Toscana (1851) (Carta storica regionale (Območni zgodovinski zemljevid), objavljen z dovoljenjem dežele Emilie-Romagne).

In the same part of *Flaminia*, the mouth of the Primaro river is lengthening towards the Adriatic Sea: this is evidence of high solid transport at that time. Because of its shape, in written and cartographical sources, part of this peninsula is frequently indicated as »Testa d'asino« (Donkey's head) (Novara, 2000).

Another sector of *Flaminia*, south of Ravenna, shows two salt-pans: Cervia and Cesenatico. Marine salt production (in the Late Medieval-Early Modern Age sources called »White Gold«) held an important role in the regional economy because as opposed to Austria or Germany, northern Italy is bereft of fossil salt deposits (Halite). The Cervia salt-pan dates back to the Early-Medieval Age and it has been preserved up till now; even the toponym »Cervia« is linked to salt production, deriving from Latin word »Acervus«, that is »heap«, in this case made of salt. The Cesenatico salt-pan was smaller and was closed during the 18th century (Tassinari, 1969). Both of the salt-pans were settled here because along the Romagna Coastal Zone marine water salinity is high, as the inflow of fresh waters from the Apenninic rivers is negligible.

Regarding the Romagna shoreline, a second map dating back to the 16th century is called *Romagna olim Flaminia* by Giovanni Antonio Magini (1555–1617), Eg-

nazio Danti's successor at the University of Bologna (1st edition, in black & white, 1597; 2nd edition, in colour, 1598; north at the top) (Faini, Majoli, 1992). Magini's representation, clearly influenced by Danti's work but less evocative in comparison with its prototype, is not a fresco: it is the first printed map of the region. In the sector devoted to the Romagna coastline (fig. 2) just 15 years after *Flaminia* by Danti, an increase of sedimentation processes is recognizable (Turchini, 2003, 176) (fig. 2, no. 1); between Cervia and Cesenatico, the salt-pans are also represented (fig. 2, no. 2).

17th–18th CENTURY CARTOGRAPHY

During the Modern Age, cartographical technique was improved: the representations dating to this period are fully scientific from a geometrical point of view.

At the same time, cartography from modern times, in particular that of the 18th century, shows an increase of the human footprint on the territory based on an improvement of technological progress and hydraulic knowledge.

Aque, Fiumi, e Scolì principali della Romagna by Pietro Maria Cavina (1641–1691) (fig. 3), an eclectic scholar from Faenza, is one of the most relevant works

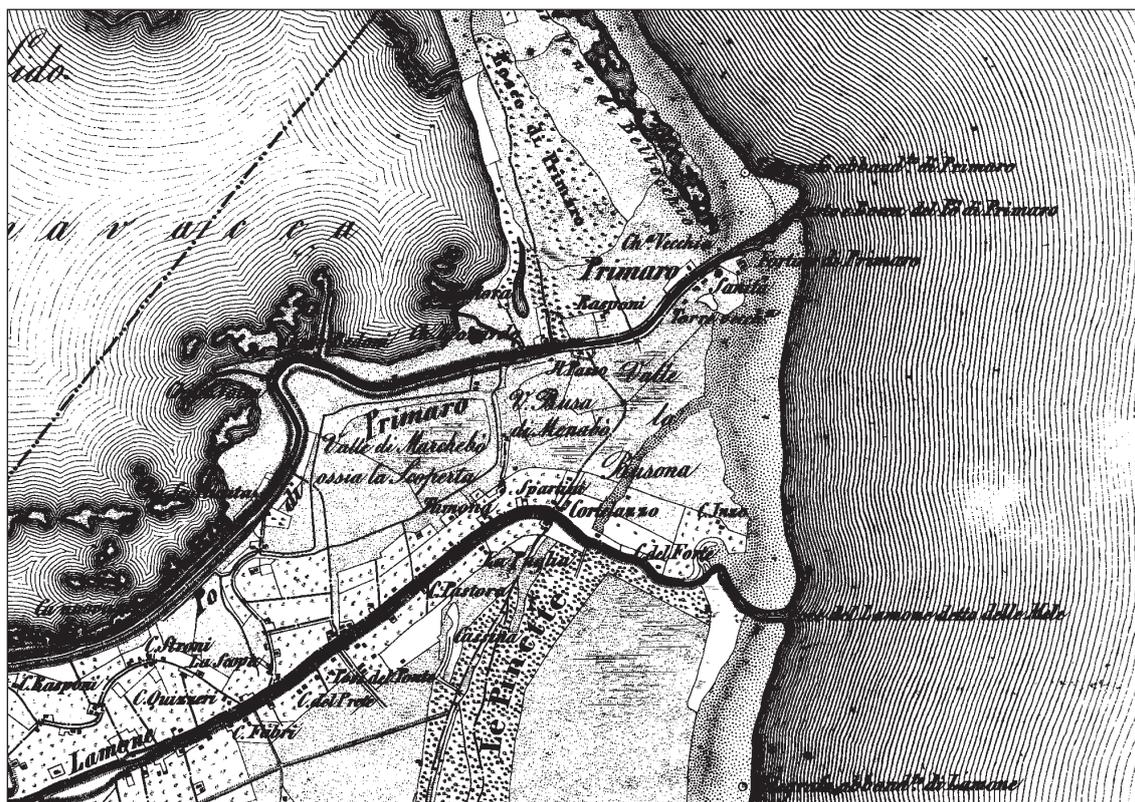


Fig. 8: Section of Carta Topografica dello Stato Pontificio e del Granducato di Toscana (1851): a comparison with the 17th century map (fig. 3) shows that the Primaro river mouth underwent an erosive process, linked to a decrease in riverine solid transport (Carta storica regionale (Regional historical map), image use authorised by the Emilia-Romagna Region).

Sl. 8: Del zemljevida Carta Topografica dello Stato Pontificio e del Granducato di Toscana (1851): iz primerjave z zemljevidom iz 17. stol. (sl. 3) je razvidno, da je bilo ustje reke Primaro podvrženo procesu erozije, povezanem z zmanjšanjem rečnega transporta (Carta storica regionale (Območni zgodovinski zemljevid), objavljen z dovoljenjem dežele Emilie-Romagne).

of the period. This printed map, dating back to 1678, was attached to an essay concerning a new navigable canal from the city of Faenza to the Adriatic Sea (Piastra, 2009); under the influence of *Flaminia* by Danti, the representation has north at the top, but diverted to the left by 44 degrees. Cavina's cartography shows a reduction in the surface of wetlands, linked to the hydraulic land-reclamations of the Modern Age; created about a century later than Danti's representation, the map presents the mouth of the Po di Primaro still lengthening towards the Adriatic Sea (fig. 3, no. 1). Further landscape elements recognizable on the map are the pine-woods, characterized by the same surface as in *Flaminia* map by Danti (fig. 3, no. 2) and the Cervia salt-pan (fig. 3, no. 3).

Regarding the Romagna coastline, another significant map of the Modern Age is attached to *Reguaglio storico della diversione dei due fiumi il Ronco ed il Montone della città di Ravenna*, a report by F. D. Bellardi dating back to 1741 (fig. 4). This cartography, in which north is on the right, must be put in relation with a hydraulic pro-

gram, concerning the diversion to the south (fig. 4, no. 2) of the so-called »Fiumi Uniti« (literally, »United Rivers«), watercourse originated from the confluence between the Montone and Ronco rivers (Fontana, 1979; Tavoni, 1981). The goal of such an ambitious operation, finished in 1739, was to direct these rivers away from the city of Ravenna in order to prevent floods. In fact, during this period floods were very common in Romagna because of the Little Ice Age (1550–1850 approx.), a period of climate deterioration (Grove, 1988).

The successful realization of such a huge hydraulic project is clear evidence of the new and more effective attention to the territory and new capabilities of governance by local authorities after the end of the economic and cultural crisis of the 17th century in Italy.

19th CENTURY CARTOGRAPHY

When the Napoleonic era came to an end, Romagna went back to being under papal power.



Fig. 9: Lido Adriano (Ravenna), located north of Fiumi Uniti river mouth: the 18th century mouth complex (fig. 4) has been eroded; currently, the sandy beaches, which are here truly endangered, are artificially renourished. The image displays speculative processes dating to the 1960s and 1970s, related to a new urbanization for the sun & sea tourism in the Romagna coastal zone (photo: S. Piastra, 2009).

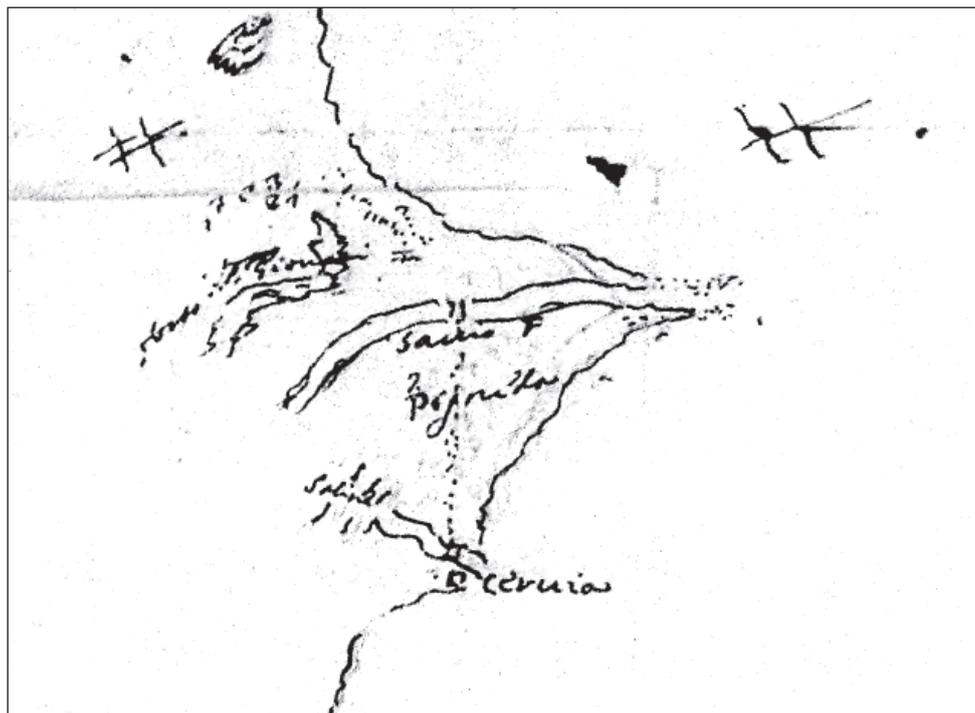
Sl. 9: Lido Adriano (Ravenna) severno of rečnega ustja Fiumi Uniti: kompleks rečnega ustja iz 18. stoletja (sl. 4) je bil erodiran; peščene plaže, ki so tukaj resnično ogrožene, so umetno vzdrževane. Iz slike so razvidni spekulativni procesi iz 60ih in 70ih let, povezani z reurbanizacijo obalnega predela Romagne za namene turizma sonca in morja (foto: S. Piastra, 2009).

A map dated 1814 of the Ferrara territory and kept in the archive of a cartographical institute originally based in Milan, depending from Austria-Hungary Empire, could be considered the masterpiece of 19th century regional cartographical representations. This large-scale colour map (1:15,000 approx.) presents a very modern symbolism, allowing us to understand landforms, land-uses, and rural settlements. It depicts only the northern sector of the Romagna Coastal Zone, in the neighbourhood of the Primaro mouth. The mouth complex, in comparison with 16th–17th century maps, has undergone a slight erosive process, to be linked to hydraulic works (immission of the Reno river into Primaro) that, during the 18th century, caused a decrease of the riverine solid transport to the sea; in the inland (on the left of the figure), regular division of land is connected with hydraulic land-reclamations; north and south the river arm are visible some fresh and brackish water wetlands; next to the shoreline, coastal woods and several dune-bars are represented. Human settlements are very rare; just some fortifications facing the sea are depicted.

Besides landscape and cartographical issues, this map also holds a political and ideological dimension: at the dusk of Napoleonic period, the Habsburg Empire,

one of the main players in the defeat of Napoleon, had at that time settled in the so-called Lombardo-Veneto and had strategic interests in the region, perhaps due to the fact that the Po river is the main navigable water-course in Italy.

A second map dates back to the second half of the 19th century: *Carta Topografica dello Stato Pontificio e del Granducato di Toscana*, 1851, drafted by the Austrian Imperial Army Geographical Institute (Regione Emilia-Romagna, 2007). This cartography, regarding the Papal State and the Grand Duchy of Tuscany (for Romagna, the last one printed before the origin of Italian Kingdom), presents a scale of 1:86,400 (the same as the famous map of France by Cassini, dating back to the 18th century); north is at the top. In the sector concerning Ravenna, pine-woods (*»Bosco detto la Pineta«*), once extending without any interruption between the mouth of the Po di Primaro river and Cervia (fig. 3, no. 2) has undergone a drastic reduction in surface (fig. 5, no. 1) and it has separated into two woods, *»Pineta S. Vitale«* to the north and *»Pineta di Classe«* to the south. Continuing the trend of the modern age, wetlands experienced a reduction in surface (fig. 5, no. 2) being partially replaced by new agrarian fields, in particular, thanks to the



Legend: North is on the top. On the map, the Savio river, north of Cervia, shows a mouth complex extending towards the Adriatic Sea; at present, it is completely eroded.

Fig. 10: Section of an 18th century handwritten map, drafted by scientist Luigi Ferdinando Marsili (BUB, ms. Marsili, 72F (*Giornali e memorie per la ricognizione delle spiagge pontificie all'Adriatico*, ms. cart., sec. XVIII); image use authorised by the Bologna University Library; Authorisation no. 3155 VI/3.1).

Sl. 10: Del ročno izrisanega zemljevida iz 18. stoletja znanstvenika Luigija Ferdinanda Marsilija (BUB, ms. Marsili, 72F (*Giornali e memorie per la ricognizione delle spiagge pontificie all'Adriatico*, ms. cart., sec. XVIII); objavljeno z dovoljenjem Univerzitetne knjižnice v Bologni; Dovoljenje št. 3155 VI/3.1).

large availability of fresh water, rice fields (fig. 5, no. 3). Such an important change in land-use seems to be put in relation with human deforestation and extensive land-reclamation (in the following decades strengthened by the introduction of dewatering pumps) as a Malthusian inspired response to a regional increase of population during this age.

In the case of the deforestation of the pine-woods, the reduction in surface was inset in the first decade of 19th century, during Napoleonic rule: in fact, Napoleon abolished monastic orders, which were since the medieval age the owners of the Ravenna pine-woods, nationalized the forest and began to exploit it.

The same map makes also possible a large resolution analysis of the evolution of human settlement in Cervia territory (fig. 6): the originary city of Cervia, located some kilometres inland and depicted in the previous cartography (fig. 2–3), at the end of the 17th century was abandoned, and re-founded, with a new rational plan, on the Adriatic Sea shores, both for environmental and economic reasons (Gardini, 1998; Giovannini, Torresani, 2001). The 1851 map drafted by the Austrian Imperial Army Geographical Institute represents both the

originary location of Cervia (fig. 6, no. 1, »Cervia vecchia«) and the re-foundation site (fig. 6, no. 2, »Cervia«).

Moreover, the *Carta Topografica dello Stato Pontificio e del Granducato di Toscana* shows also, for that time (1851), the total disappearance of Cesenatico salt-pan, now converted to new agrarian fields (fig. 7, no. 1).

CONCLUSION

As this case-study demonstrates, historical cartography plays a key-role in analysing the evolution of the landscape in sandy coastlines.

From a methodological point of view, fast evolutionary trends in sandy beaches such as those of Romagna, necessitate an interdisciplinary integration between scientific (physical geography, paleo-climatological studies, hydrology, etc.) and the humanities (human geography and history) more than other coastal geomorphologies. Such an integrated approach implicates for geographers, multidisciplinary skills (toponymy; historical maps; field research; historical documents sometimes written in Latin or archaic Italian with a difficult paleography; etc.).

Concerning the scientific issues of the paper, comparing historical with contemporary cartography or satellite images, the erosion of river mouths is the most impressive recognizable process. Besides the case of the erosion of the mouth of the Primaro, inferable by comparing 16th–17th century maps (fig. 3) with those of the 19th century (fig. 8) (Stecchi et al., 2005), also, the Fiumi Uniti mouth complex, once lengthening to the Adriatic as visible in the 1741 map (fig. 4) has, in the last century, been completely erased by sea action. Nowadays, seaside resorts are protected from erosion through artificial rocky cliffs and sandy beaches are artificially renourished (fig. 9). The same situation arises in the case of mouth of the Savio river north of Cervia: comparing an 18th century handwritten map drafted by the scientist Luigi Ferdinando Marsili (1658–1730) during his field-trips in Romagna and Marche coastlines (fig. 10) with present-day satellite images, a peninsula-shaped mouth has been completely eroded.

Coastal erosion was indirectly inset by anthropogenic hydraulic projects (dams, new canals, river di-

versions, hydraulic land-reclamations) carried out mainly during the second half of the 19th–20th century: rivers solid transport was stopped and natural coastal nourishment was arrested.

The reduction in surface of pine-woods and wetlands is another long-term trend rising from the maps to be linked to the overexploitation of forests, to population growth and to the necessity to create new lands for agriculture.

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PREUČEVANJE RAZVOJA OBALNIH OBMOČIJ ROMAGNE (SEVERNA ITALIJA). PRISPEVEK ZGODOVINSKE KARTOGRAFIJE

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POVZETEK

Poleg geoarheologije, pisnih virov in toponomastike predstavlja zgodovinska kartografija enega najpomembnejših virov za preučevanje območij, kjer so dejavni hitri evolucijski procesi, kot so to peščena obalna območja. V primeru jadranske obale Romagne v severni Italiji, ki se razteza med ustjem reke Primaro-Reno na severu in rtom Focara na jugu, gre za naravno ali umetno povzročeno obalno sedimentacijo in erozijo, ki sta se, kot je to značilno za peščene plaže, skozi stoletja izmenjevali in močno vplivali na poseljevanje, pristanišča in rabo zemljišč. Zgodovinska kartografija nam omogoča rekonstrukcijo teh trendov v zadnjih 400 letih in analizo človeškega odziva nanje. Zemljevidi iz 16. stoletja (Flaminia avtorja E. Dantija, 1580–1582; Romagna olim Flaminia, G. A. Maginija, 1597) prikazujejo daljšanje rečnih ustij do Jadranskega morja ter pasova borovih gozdov in mokrišč, ki ležita tik za obalo. Kartografija iz 17. in 18. stoletja (npr. Aque, Fiumi, e Scoli principali della Romagna avtorja P. M. Cavine, 1678; zemljevid, priložen delu Ragguaglio storico della diversione dei due fiumi il Ronco ed il Montone della città di Ravenna avtorja F. D. Bellardija, 1741) beleži zmanjševanje mokrišč, kar je povezano s hidromelioracijo zemljišč in antropogenimi preusmeritvami rek, da bi ublažili poplave, povezane z malo ledeno dobo (1550–1850). V zemljevidih 19. stoletja se krčenja borovih gozdov in obsežna melioracija zemljišč odražajo kot odgovor na regionalno povečanje prebivalstva v tem obdobju. Primerjava zgodovinske kartografije s sodobno kartografijo in s satelitskimi posnetki kaže, da je najizrazitejši proces v zadnjem času erozija obale in rečnih ustij zaradi jezov in antropogenega vodnega gospodarstva.

Ključne besede: obalno območje Romagne, razvoj pokrajina, razvoj obale, zgodovinska kartografija

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