MAKING OF THE LANDSCAPE: ADRIATIC COAST

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MAKING OF THE LANDSCAPE: ADRIATIC COAST

NATURAL CONDITIONS
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ORGANISATION OF THE TERRITORY
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EARTH
Travertine
Gravel
Land erosion
Protection from land erosion

RIVER
Riverbed
Fluvial erosion
Protection against fluvial erosion and from floods

COAST
'Mangia la costa'
Artificial beach
Sand

ENTITY OF EARTH RIVER AND COAST
Landscape dynamism as a consequence

DRAFT
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NATURAL CONDITIONS

Why does Italy today look the way it does? Different times and states have shaped the territory and have left their traces in the form of topographical and geological qualities. These build the foundation for the individual uses of the surface and are therefore a substantial help in the attempt to understand the making of a landscape.

4.5 Mio Years ago

Currents and forces compress different fragments of earth.

18'000 years ago

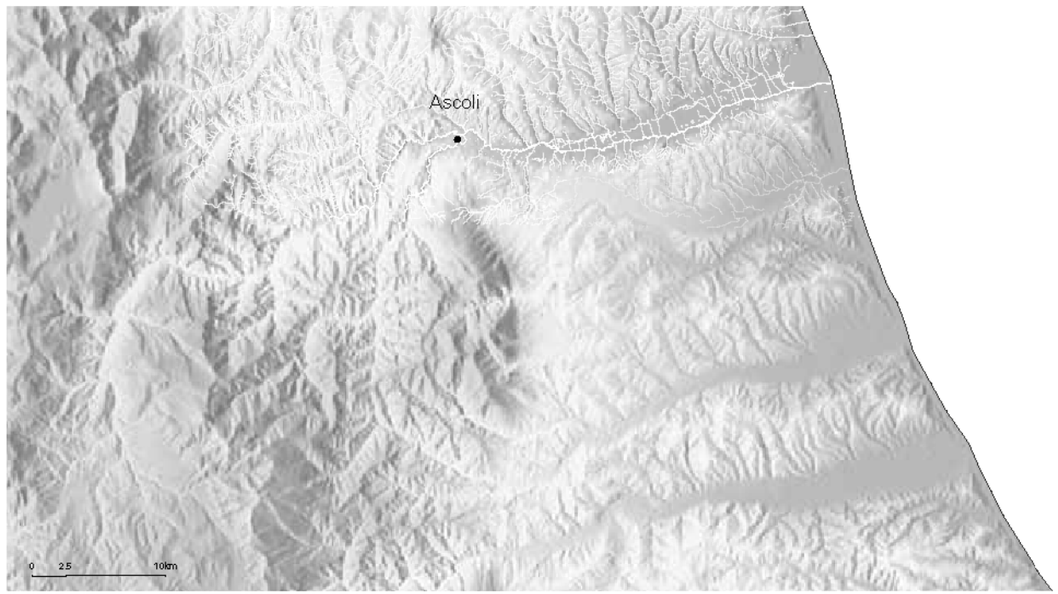
At the end of the glacial period the ice begins to melt. During this process in which the water finds its way down the mountains, rivers are formed. These rivers rinse out sediments and accumulate valleys. The water level rises.

Formation: the origin of Italy

For billions of years the different fragments of the earth are constantly dispersed and compressed. Thereby the surface of the earth is altering; mountains and valleys arise. Pieces, arriving from the northeast start to form Italy' s characteristic profile.

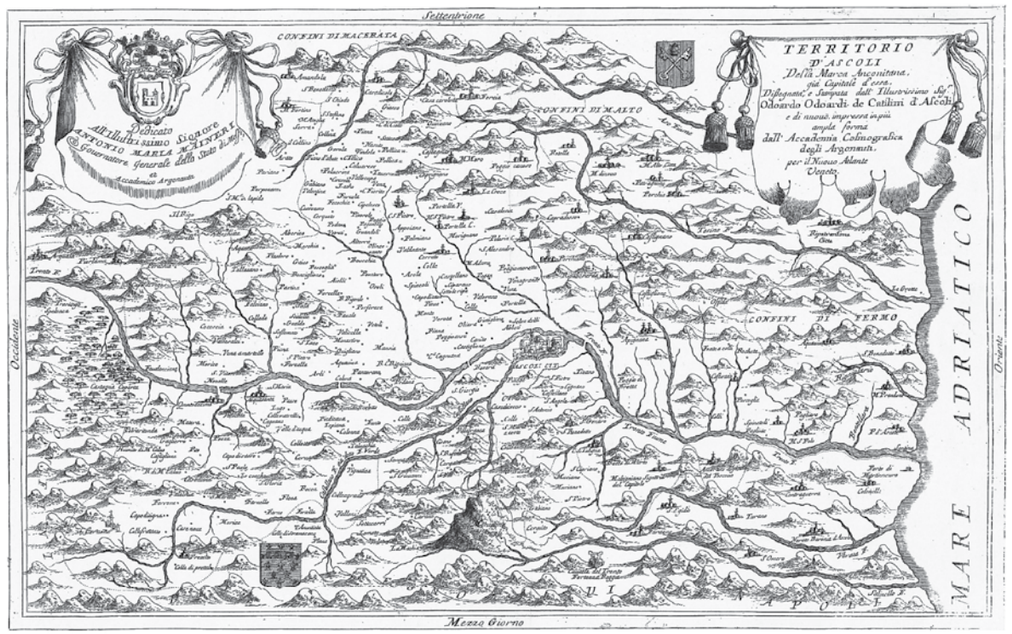
Italy today

The Apennine forms the backbone of Italy. The 1500 km long mountain range divides the country into a western and an eastern part. In the latter, an even coastal plane extends along the Adria and ascends over hilly land into a steep mountainscape.



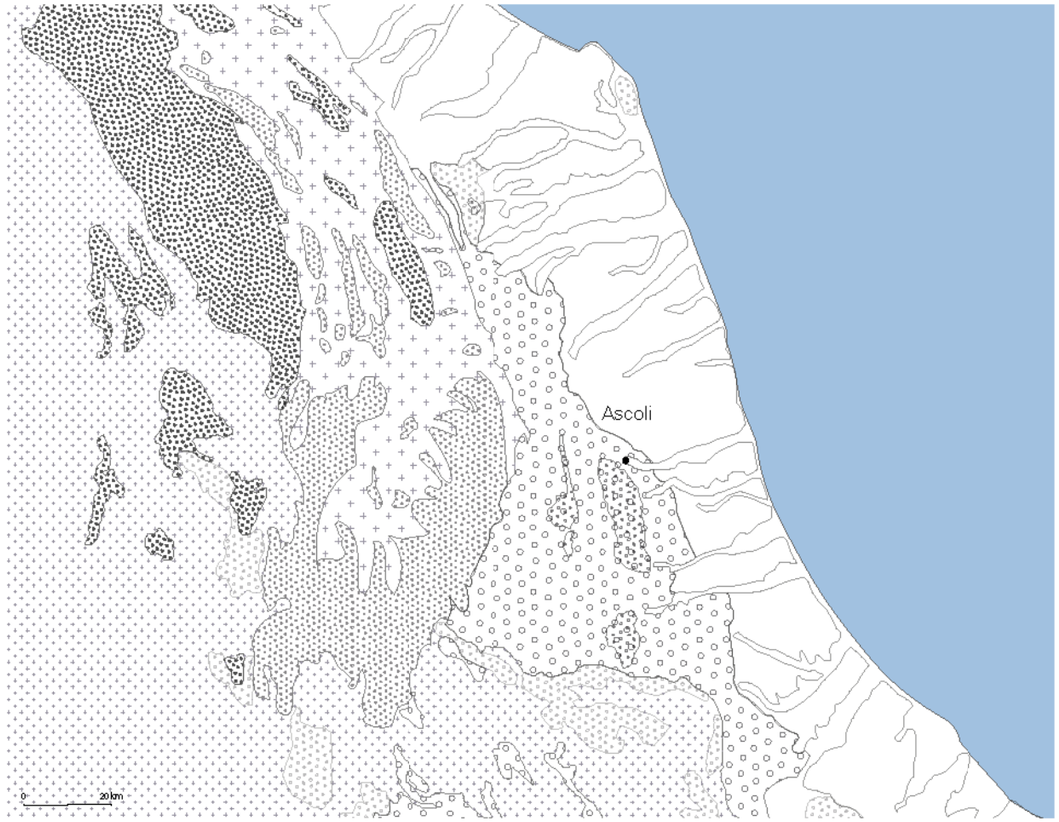
Topography: a sequence of mountains and valleys

The northern part of the Abruzzo region shows a similar landscape that evolved due to camparable conditions. Its mountains and valleys originated by the pressure of the tectonic plates and the melting of ice. This region consists of three parts: the plain part along the coast and in the valley floor, the hilly slopes and the steep mountainscape.



Mountains, rivers and sea

The ramified river Tronto manages its way through the mountaineous landscape before it opens out into the Adriatic Sea (representation of XVII century).



- sands and gravels
- clays with intercalacted sandstones
- sandstones with intercalacted clay
- travertine, marls, marly limestones
- limestones with minor marls
- clays with intercalacted sandstones
- pelites and marls with interbedded sandstones
- pelites sands and conglomerates

From mellow sandy soil to hard rock

Alongside the coast and in the region of the slopes the earth is mellow and fertile. With the ascend of the territory the stability of the earth increases.

Geology: the basis of landscape dynamics

Characteristics of soil determine the different possibilities of use as they are of diverse resistance to natural and human actions. Looking at a geological map, one can draw a conclusion about the development of an area.

Sand
not consolidated sediment rock, different grain sizes, non-cohesive earth, important commodity for the building sector

Clay
stores heat, formable in moistly state, very fertile soil, oldest binding agent

Sandstones
decomposition resistent, nutrient-poor

Travertine
special type of limestone, high water apsorption, easily processible, light weight; used as building material

Limestones
sedimentary rock, big grain size; used in building sector, as fertiliser and as a binding agent for concrete

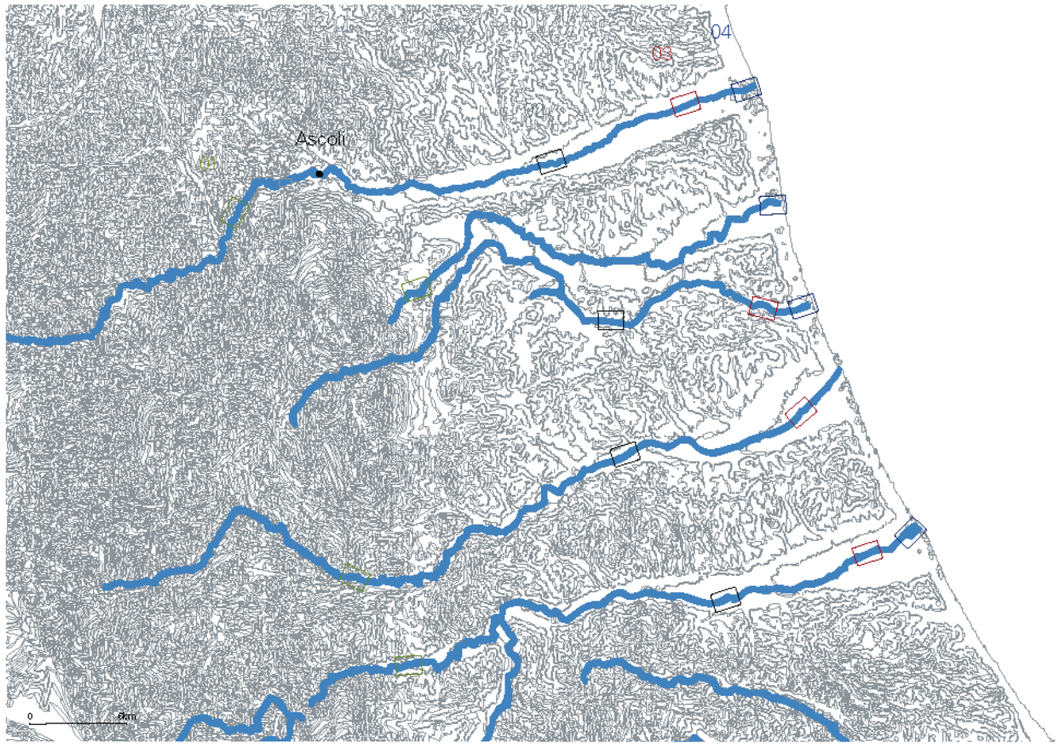
Pelites
sedimentary rock, little grain size

ORGANISATION OF THE TERRITORY

Historically, the area was substantially shaped by agricultural practices. Beginning with urbanisation processes in the middle of thr 20th century a strong transformation was set in motion.
New connections due to traffic infrastructure, allocation of industries and the opening up to mass tourism created a fragmented, heterogenous settlement structure.
Topography represents a natural condition, influencing strategies for settlements and agriculture troughout history.

Porto d'Ascoli

Ascoli



River by river

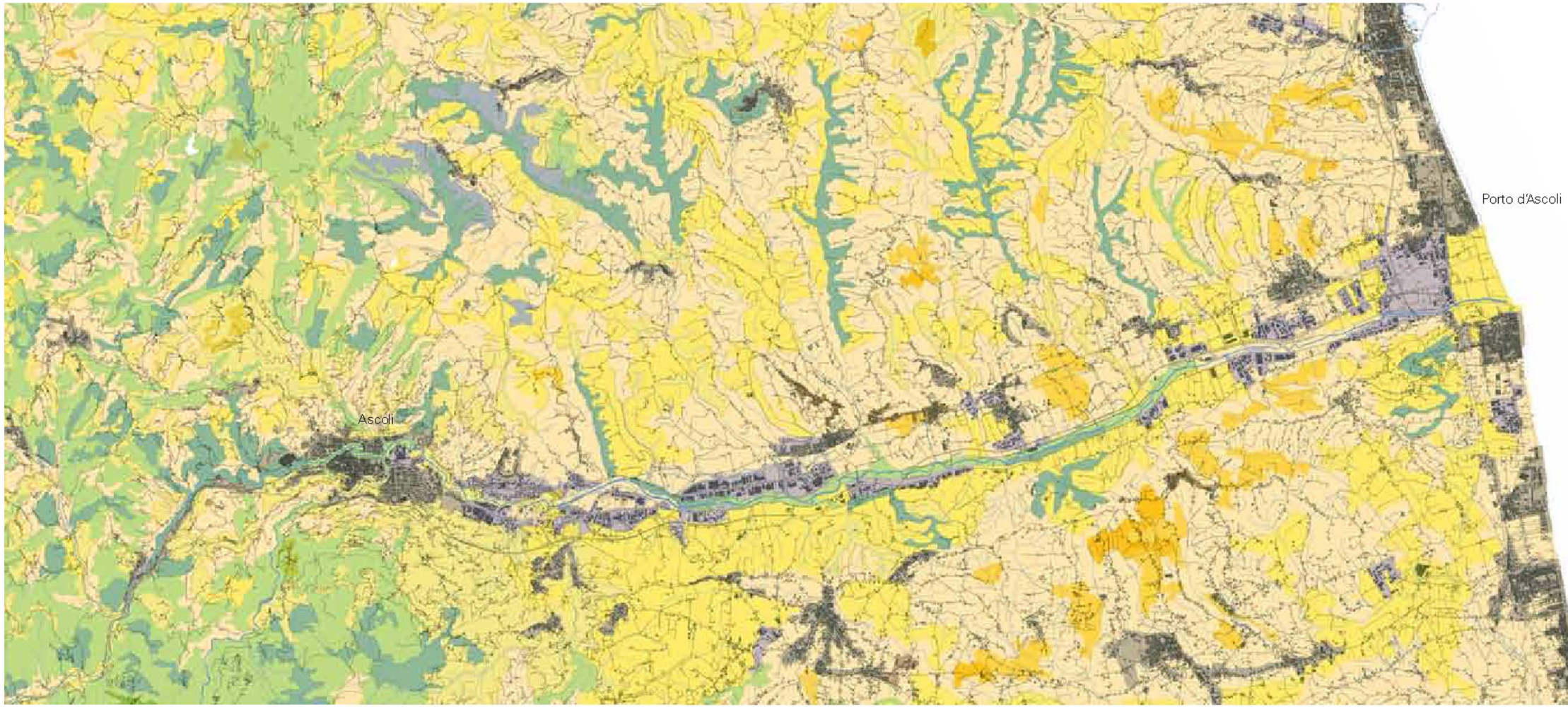
Alongside the repetitive topography the rivers at the valley floor present an organizing constant.Their appearence changes distinctly towards the coast. While they carve their way freely in the hinterland, uilt flood and erosion protectors downstream have a strong impact on the evolution of the riverbed.

01

02

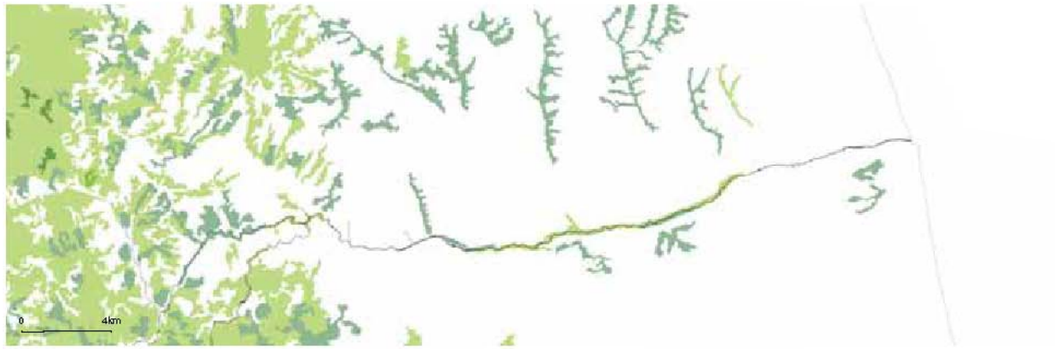
03

04



Land use: from arboreous mountains to the densly populated coast

The overlay of the different landuses shows that according to the geological situation three types of regions can be differentiated: A rather sparsly populated area in the mountainscape, vegetated by bushes and forests, the slopes facing the valley which are covered with olive and vine plots and finally the fertile alluvial plain, which in conjunction with the flat coastal area is densely occupied by newer settlements, industries and horticulture.



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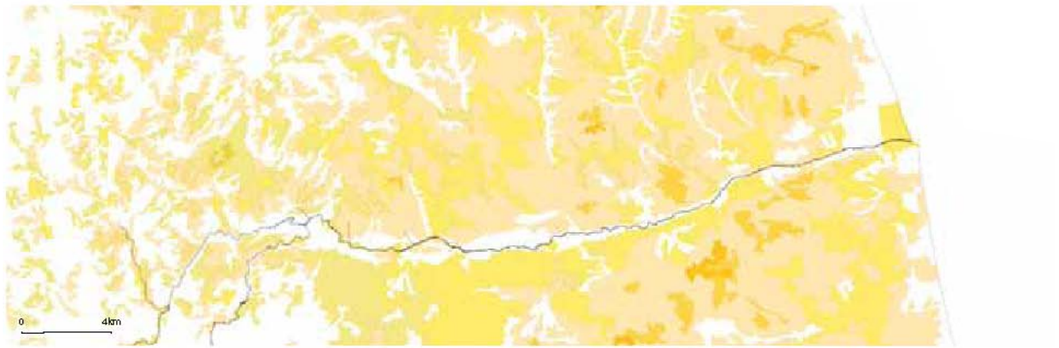
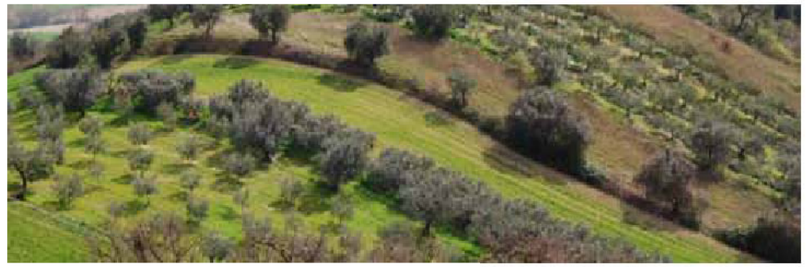


02

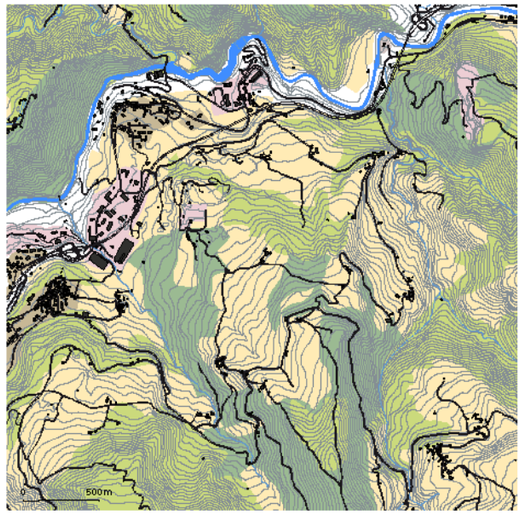
03

bushes
forests
acres & meadows
olives, vines and horticulture
residential areas
industrial & commercial areas



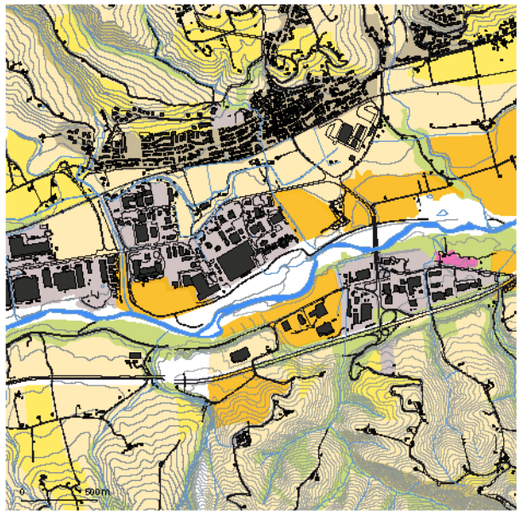
Land use

01 The Apenine foothills are covered with a mixture of decidous and coniferous forests
02 A substantial part of the lanscape consists of fields. There are two kinds: seminativo nudo and seminativo arborato
03 Modern settlements and industries developed almost exclusively in the alluvial plain and on the gently inclining coastal area.



01
Upper valley

The land around the mountain villages is cultivated by peasants. Existing travetine deposits are extracted from the hills and processed along the river.



02
Mid valley

At the bottom of the mid valley big scale industrial complexes and malls have settled. Big farms cultivate olives, vines and vegetables

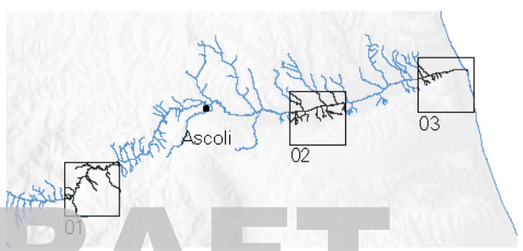
- acres & meadows
- olive and vine cultivation
- horticulture

- bushes
- forests
- calanchi

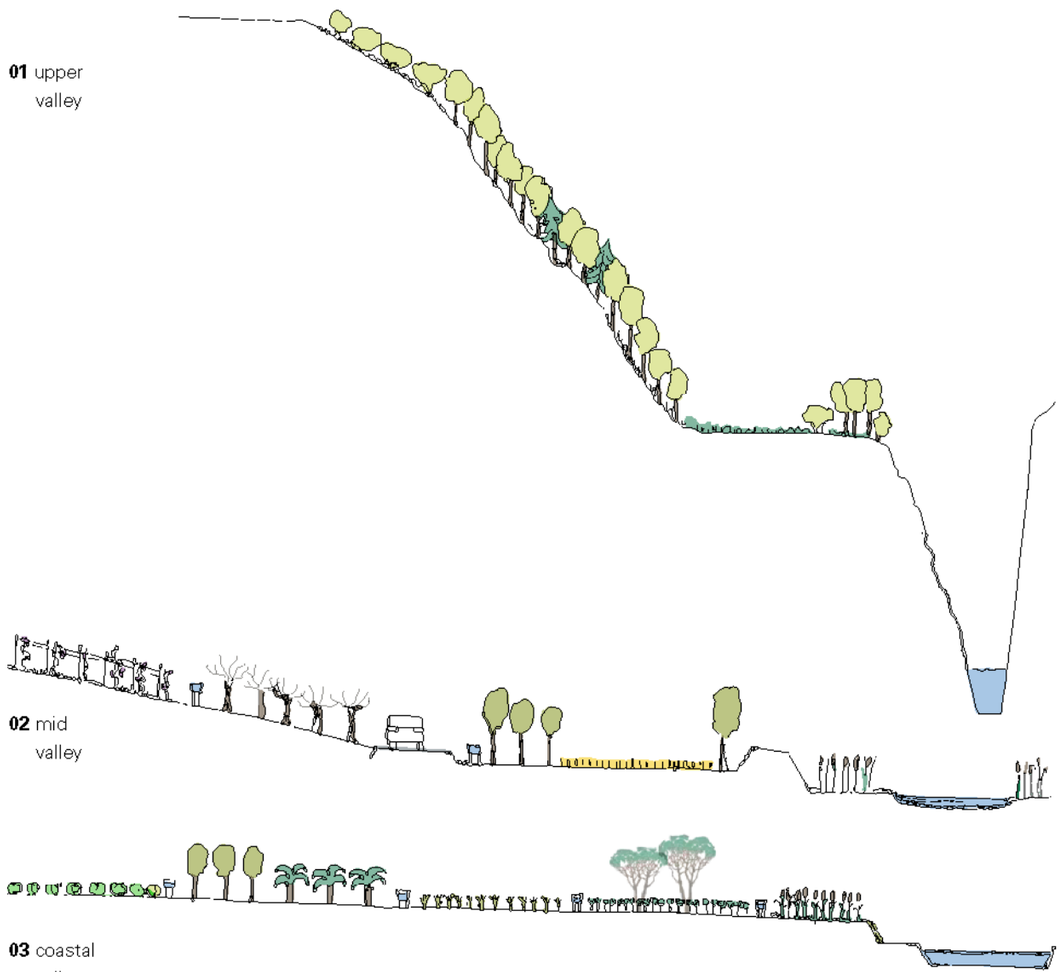
- residential areas
- industrial & commericial areas
- stone quarring & processing
- gravel pits

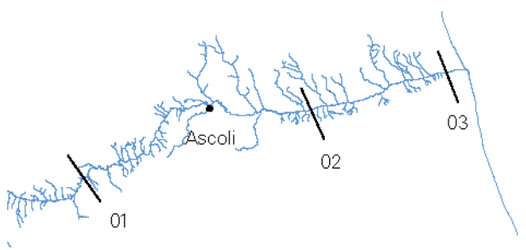
03
Coastal valley

The alluvial plain as well as the coastal zone are the most valuable areas and therefore, densley populated.
Here are the most profitable cultivation types located: horticulture and fruit trees.



Three characteristic areas



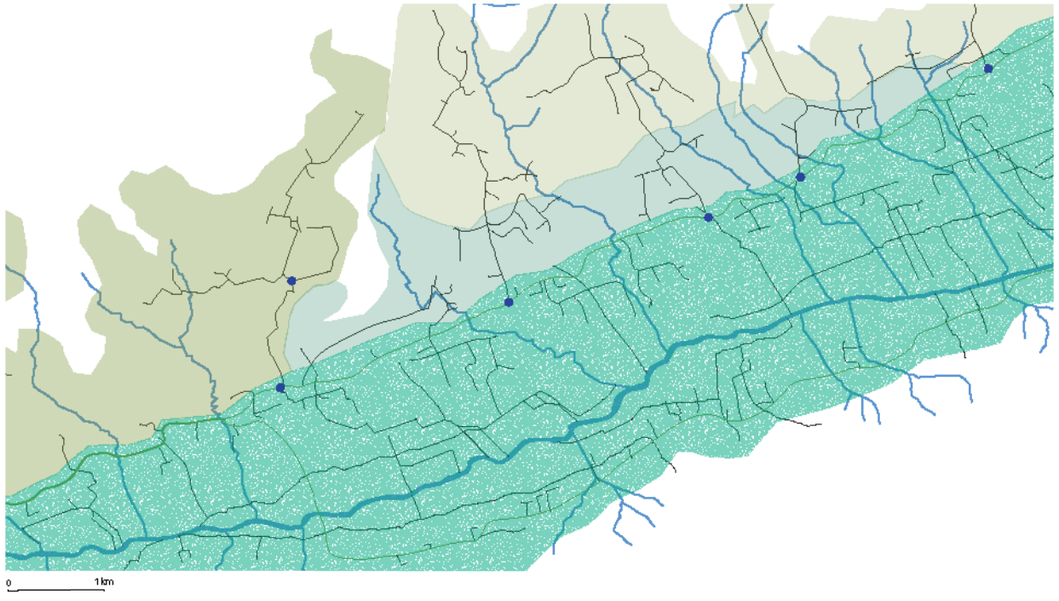


Three characteristic sections

01 02 03 04

Different parts of the irrigation system

01 At the starting point of the irrigation system water is retained and branched off.
02 One feed line transports water to a secondary system, due to fast water flow electricity is produced.
03 Secondary system that splits up and runs parallel on both sides of the Tronto River.
04 A distribution system where farmers can connect their individual irrigation devices provides smaller districts with water.



Irrigation: a controlling water system

For a long time the Tronto river was a hard to control force that had a big impact on the lives of the area's inhabitants. Since the errection of an irrigation system this ever-changing river has become more and more manageable. 71% of the valley are irrigated. To prevent water loss, 19 million Euros were invested in the context of the 'programma irrigazione 2002'.

Hierarchy of water systems

In the extending part of the Tronto Valley a ramified irrigation system starts to unfold. It extends over 224 km and is in use from april until october. If it is necessary to transport water uphill, water pumps and pressure lines are being utilised.

Territorial evolution: from agriculture to industry

Traditional mixed farming, with low income and stress on substitance production, persisted unusually long due to natural constraints. The rapid industrialisation in the 1960's led to a massive reduction of agricultural workforce. The remaining farmers were forced to modernise and specialise in crops of high demand.

1850

-small, dispersed farms, often isolated due to strong topography and slow streets
-soil with susceptibility to erosion, difficult for cultivation

1900

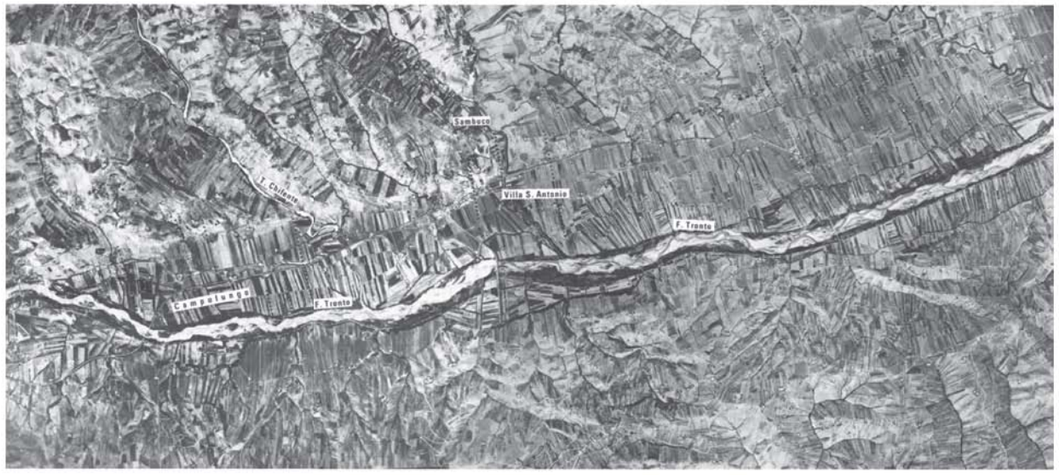
-parcels are fragmented by inheritance
-slow opening of the area due to new streets and railway

1950

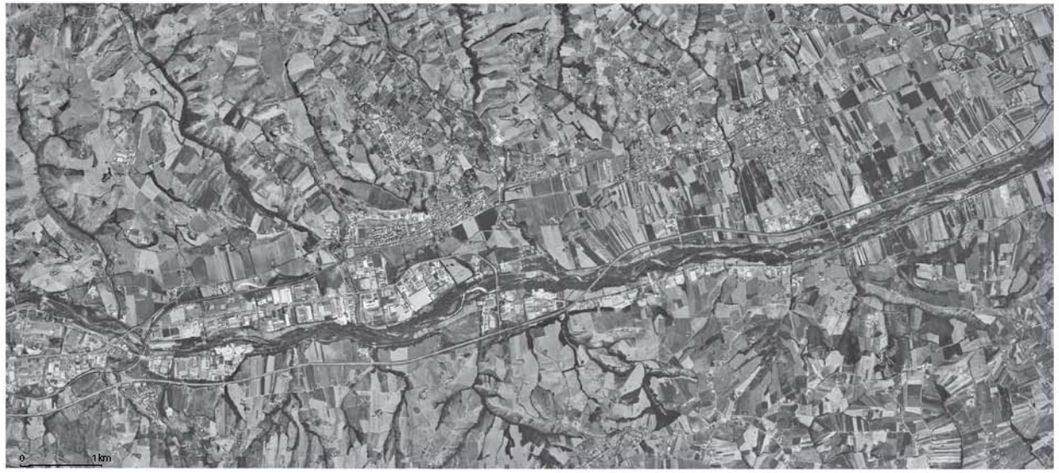
-rapid mechanisation and industrial location
-farmers leave for industries
-intensification and specialisation of remaining farmers
-conversion of redundant farms into residential buildings

1980

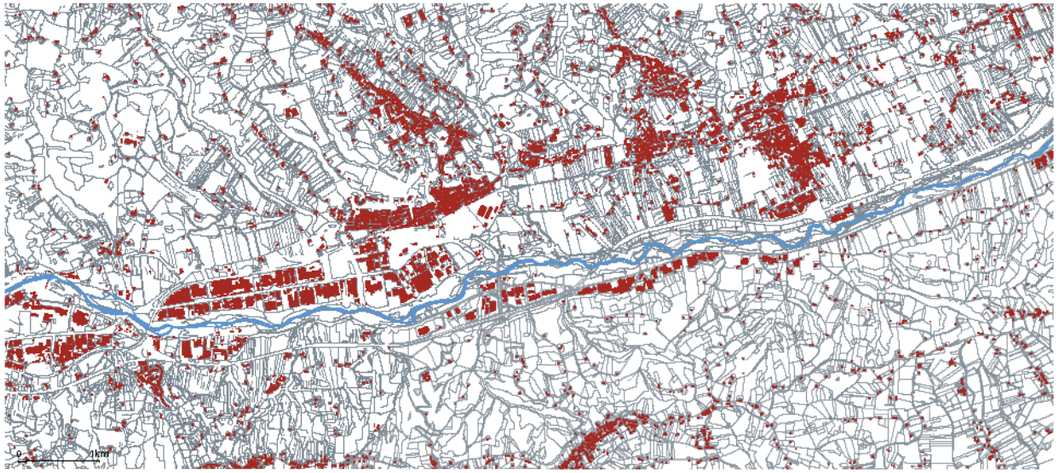
-industrial location continues
-development of new residential buildings
-new specialisation on organic quality products and agricultural tourism



1954



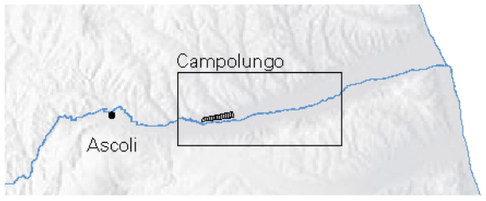
1990

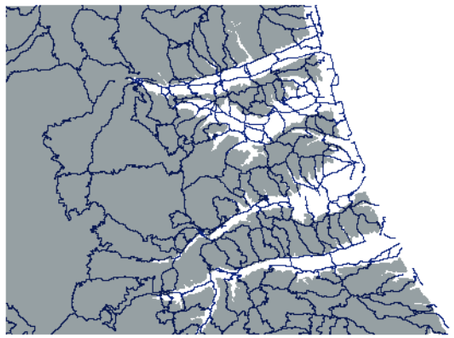


Campolungo: then and now

1954: the alluvial plain is covered exclusively with acres. The associated farm houses are scattered on the adjacent slopes.

1990: establishing industries depend on a location near the river. They push aside the agricultural structures but at the same time inherit their pattern.





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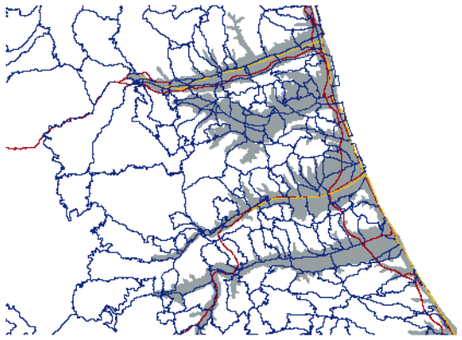


02

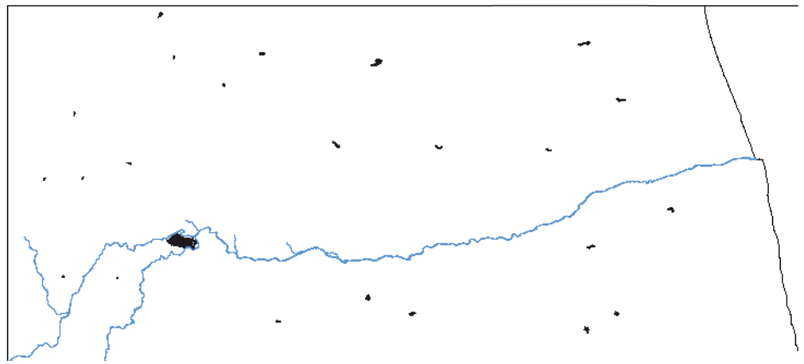
SS 16, built 1928
Highway A 14, built 1965
Railway, built 1863

Settlement movement downhill

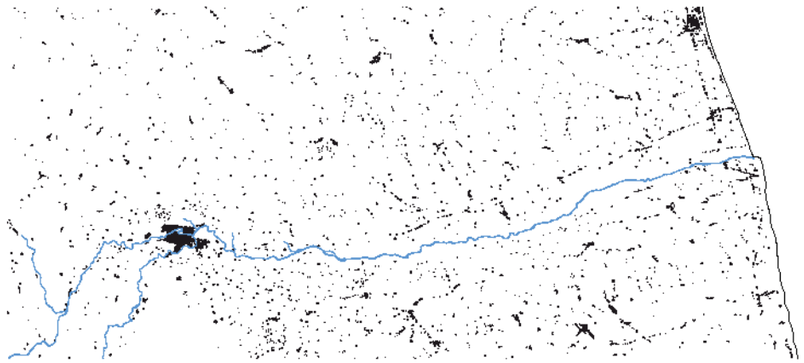
01 Up untill mid XIX century bad health conditions in the swampy lowlands as well as defence strategies encouraged settlement on the hilltops.
02 Modern infrastructure such as the railway, the 1000 km long SS 16 and the highway, all running parallel in the plain area propel a migration shift downhill.

Tronto Valley settlement expansion

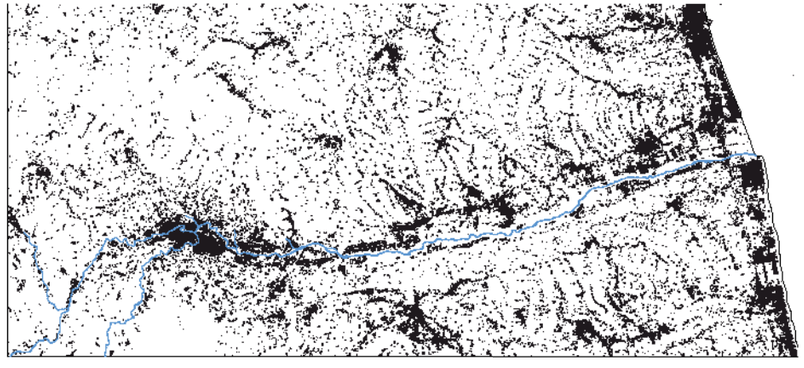
While the old villages developed on the numerous crests and summits, more recent urbanisation processes such as industrialisation and the coastal expansion took place in the plain. In this manner two urban systems evolved.



1200



1954

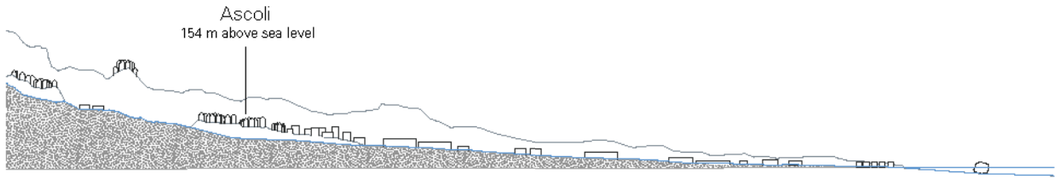


2006

Urbanisation troughout history

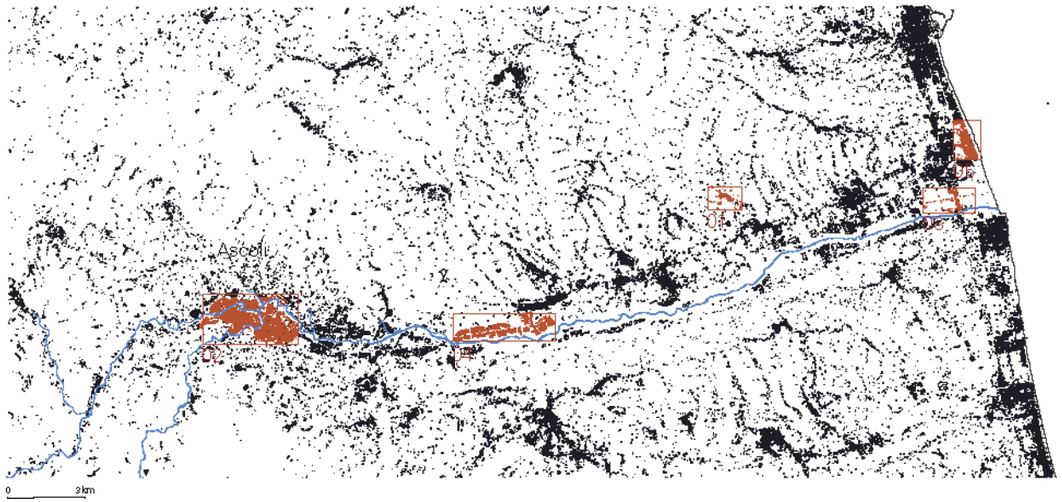
Around 1200 settlements develop around fortresses on the hilltops. With the end of feudalism in 1806 a diffusion of ownership is set in motion and many little farms emerge. In the following 50 years, the population doubles as a consequence of the improved living conditions.

1863 the railway connecting Bologna-Pescara is constructed. The settlement strip along the coast starts to densify. The construction of the highway along the coast in 1965 marks the peak indicator for building expansion.



Longitudinal section trough the Valley

The mountain villages and the quarry industry are situated on the hilltops (01). In the suroundings of Ascoli (02) and towards the coast, industrial complexes were errected (04). Small farmhouses are scattered over the hole area (03). The Adriatic City (05) was built directly at the coast.

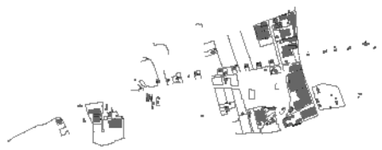


Heterogeneous settlement patterns

As the different epoches added their share to the settlement fabric by pursuing a certain strategy, today's landscape is occupied by heterogenic structures.

01

02



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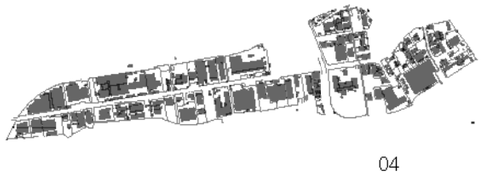


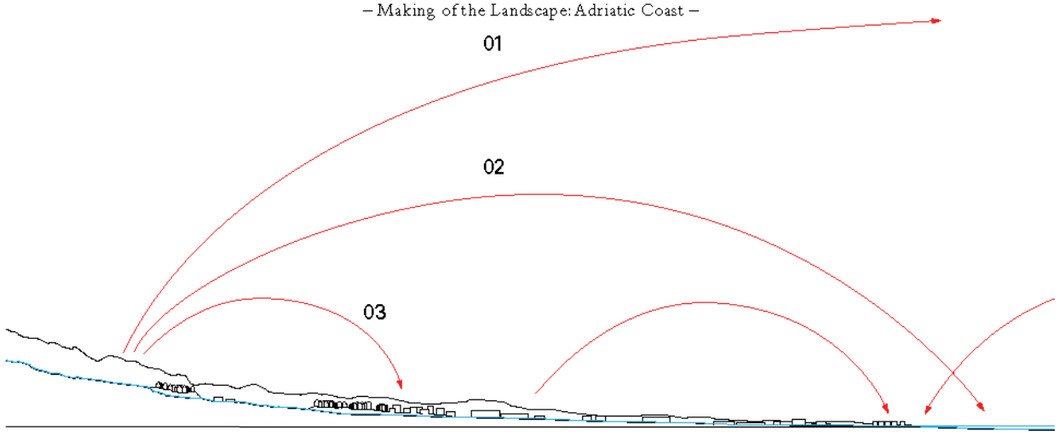
04

05

1 old core on hilltops (Monsampolo)
2 medieval town (Ascoli)
3 dispersed farms (near Tronto rivermouth)
4 industrial area (Campolungo)
5 Adriatic City (Porto d'Ascoli)

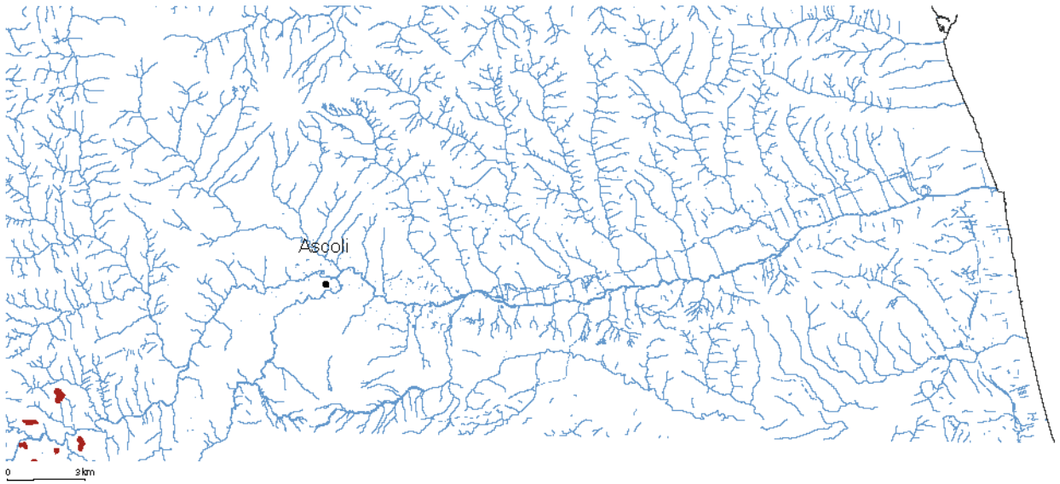
EARTH

The geologically determined weak soil substrata represents a permanent constraint for its users and occupants. On the other hand, the extraction of local ground deposits is a viable income. Yet particularly the withdrawal of gravel from the riverbed further destabilises the land.



Shifting travertine

The travertine is exported to countries all over the world (01) while pieces of secondary quality are used as wave breakers along the shore (02). Houses, churches and squares of the old towns are often made out of travertine (03).



Extraction

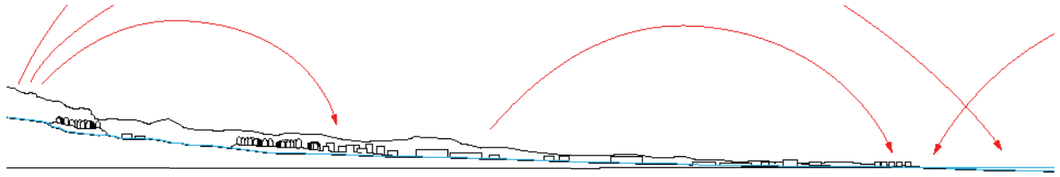
The quarries are distributed over the few hills in the mountainscape where travertine eixists. The processing industries are located along the river.

Travertine

The combination of a specific limestone with heat produces travertine. While formally used as the main local building material, today`s emphasis lies on worldwide export. Its visual qualities, the low weight, the ability to absorb water and the easy processibility account for the popularity of travertine.

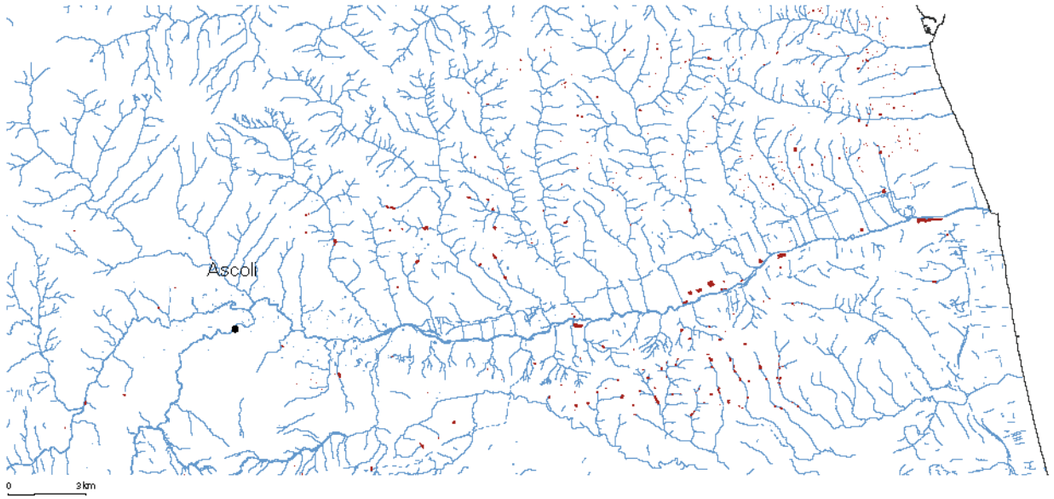
Processing

For the extraction, holes are drilled into the rock and a saw cuts out a shape before a caterpillar loads the block (01). In the processing facility the stone's use is determined by it's colour, stability and size (03). The blocks are cut into thin slices (03), polished and prepared for export (04).



Shifting Gravel

In connection to the strong building activity between 1950 and 1985 a considerable amount of gravel for concrete production was taken from the riverbed. Also today concrete made from local gravel is used for the building sector.



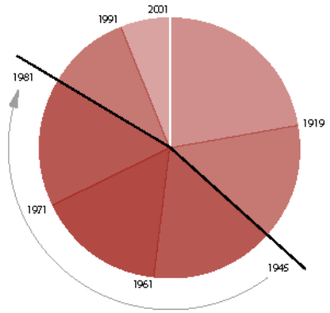
gravel pits

Extraction

The gravel pits are lined up along rivers and torrents. The gravel is taken either directly out of the riverbed or from the parallel running sandy section.

Gravel

Starting with the building boom in the 1950s concrete replaced travertine as the commonly used building material. The gravel for the concrete production is extracted from the riverbeds. For this reason gravel pits and concrete factories are an inherent part of the landscape.

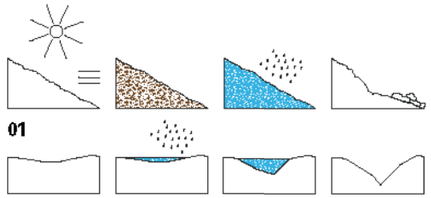


Building boom

Almost half of the existing building mass of the province Ascoli Piceno was constructed in just 35 years

Gravel pit

The gravel is either taken out directly of the riverbed or out of the parallel running sandy sections, like it is the case in one of the largest extraction lots next to the river Salinello (above). The extraction is limited by law to the strata above ground water.

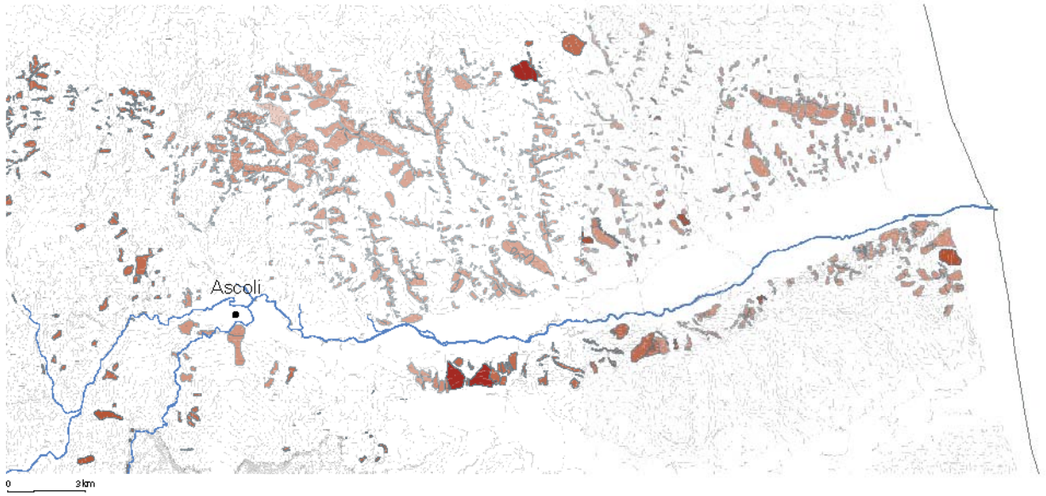


01

02

Forms of erosion

01 Landslide: if instable soil is exposed to solar radiation and wind the soil substrata turns porous which absorbs rain water like a sponge. Mainly on steep slopes this heavy mass slides down easily if not supported.
02 Channel erosion: irregularities in the terrain are deepend by rainwater runoffs.



The calculation of danger

To classify the danger erosion implicates, there are three important factors which have to be considered: the location on a slope, the soil condition and the potential danger for humans.

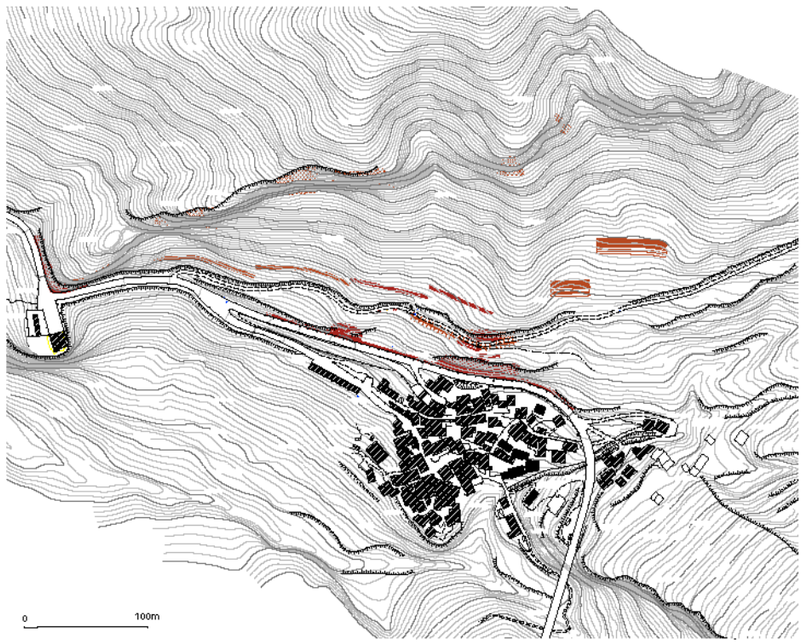
- very high risk of erosion
- high risk of erosion
- middle risk of erosion

Land erosion

In many areas of the Tronto Valley soil erosion poses a threat to the population and to the usable surface. This natural process is intensified by human actions. As a protection, fences are installed and fixation walls are built. A possibility to prevent erosion in the first place is to cultivate trees or bushes whose roots keep the earth together.

Calanchi

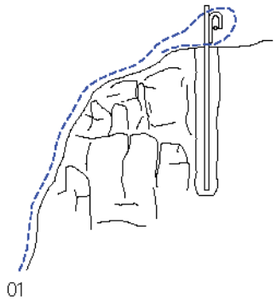
One special phenomena of land erosion are the Chalanchi. They originate from a combination of landslide and channel erosion. Additionally to climate and soil conditions, the enlargement of agricultural plots and their ploughing with modern machines are a constituting factor. Particularly in the area around Atri, a considerable part of formerly agricultural used surface has fallen victim to this development.



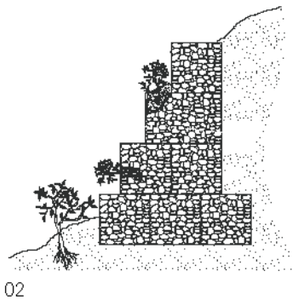
free-standing fence
wrapped metal fence
gabbioni

Protection from land erosion

The inhabitants of Colle d'Arquata live in an especially endangered area. To protect their village from this risk, baskets filled with stones are used to build walls which support the hillsides. A more costly way of protection is the injection of chemicals into the earth.



01



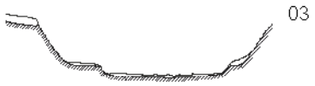
02

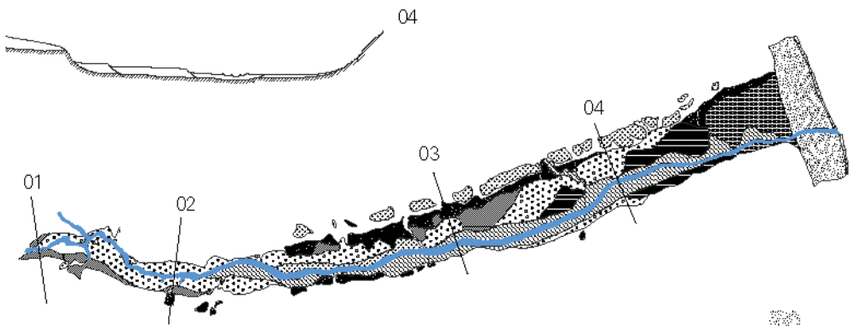
Types of protections

01 Metal fence, this method can be carried out up to a declination of 70 degrees.
02 Gabbione, box-shaped metal net filled with stones. The right weight, porosity and form of the structure allow movement and deformation.

RIVER

In his role as transporter and resource, the Tronto river is used for a wide range of activities. Water is branched off for industry, agriculture and power production. Furthermore, people benefit from the fact that the river constantly sweeps along sediments. They are extracted extensivly in order to produce concrete. Responding to external impacts like these, the River is in an ongoing process of changing its form and course. In autumn when heavy rains go down in the area and especially in spring, when melt water comes flowing down the mountains, the river becomes a threat. To minimise the flood threat, protection systems are erected.





Holocene origin
10'000 BC until now

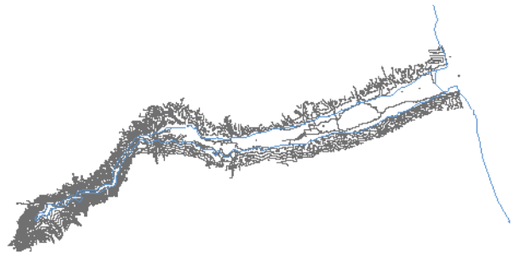
Pleistocene origin
586 milion years BC
until 10'000 BC

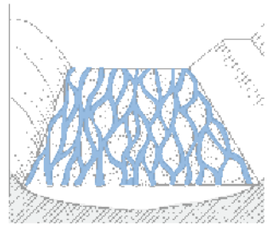
River terraces today

Different terraces testify to their time of origin. The way the terraces are formed tell about the water level, the condition of the river, the soil quality of that time and much more.

Riverbed

The course changes of rivers remain readable for a long time due to the shape and the configuration of the terraces. Here, any human or natural modification manifests itself. The riverbed is geologically subdivided into three sectors. The 6 km long piedmont sector is characterised through a steep longitudinal section and a narrow thalweg. In the 21 km long mid-valley the thalweg enlarges. The coastal sector shows a gently sloped terrain and a broad profile.





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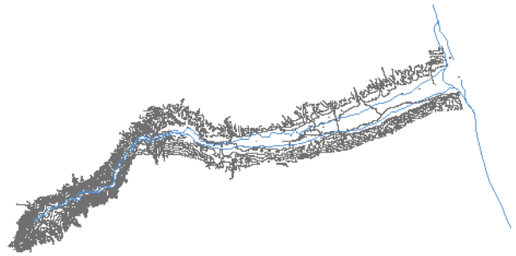

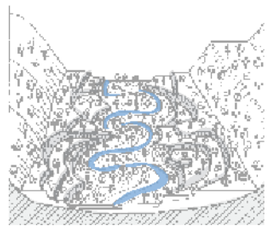

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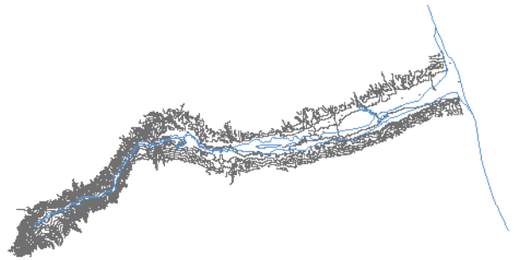

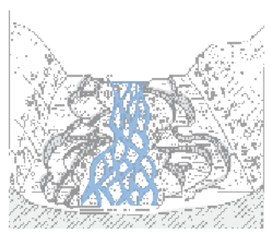

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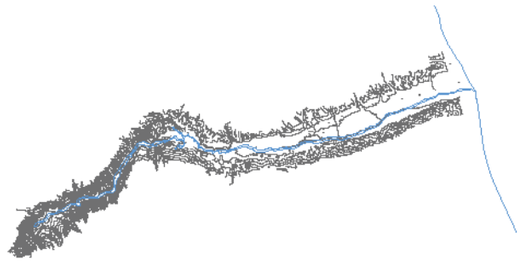
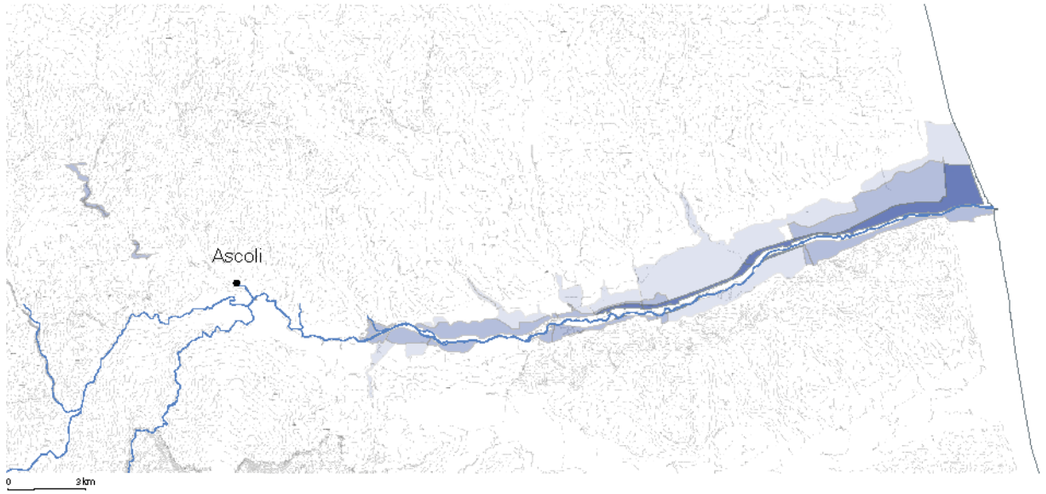


04

Evolution of the riverbed

01 The braided channels are characterised by a rapid aggradation.
02 The downcutting by meander courses produced a number of erosional terraces.
03 A braid plain and soil erosion processes evolve after the slope occupation for agricultural purposes between 1100 and 1800 AD.
04 The braid plain progressive narrows and deepens due to land use changes, the creation of artificial levees and the first excavations of gravel.

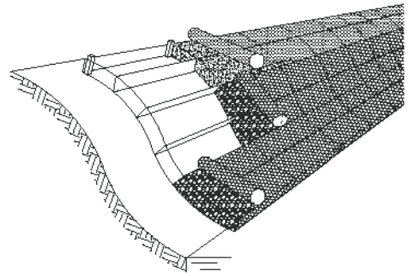


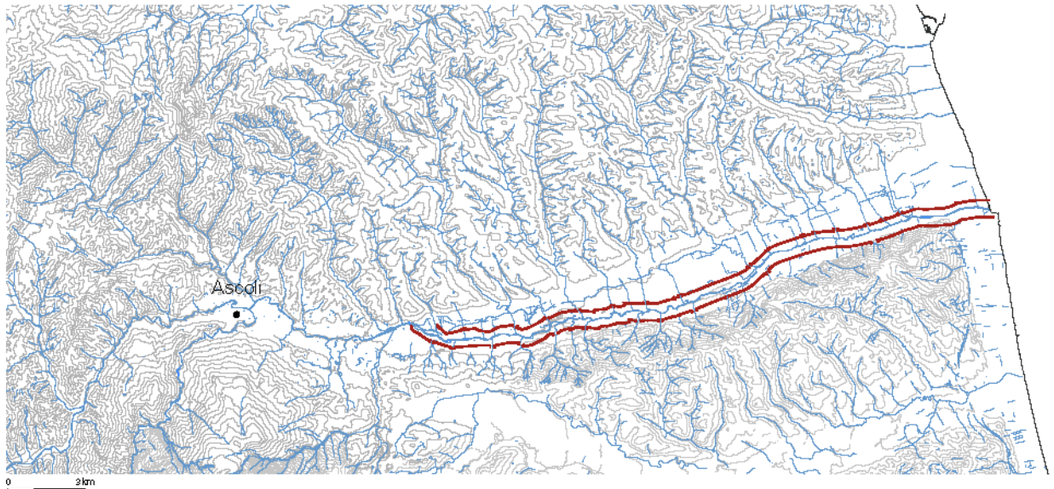
Fluvial erosion and floods

The river constantly transports sediments towards the sea. On its way downhill the walls of the riverbed are being eroded. Especially in rainy seasons, when the river tends to flood, it sweeps along surface material of the alluvial plain.

Susceptibility to floods

For the allocation of flood risk zones different factors are considered: proximity to the river, use of the area and number of affected people.





artificial levees

Artificial levees

Where the adjacent land is flat, it is necessary that both sides of the Tronto river are accompanied by a continuous line of artificial levees.

Protection against fluvial erosion and from floods

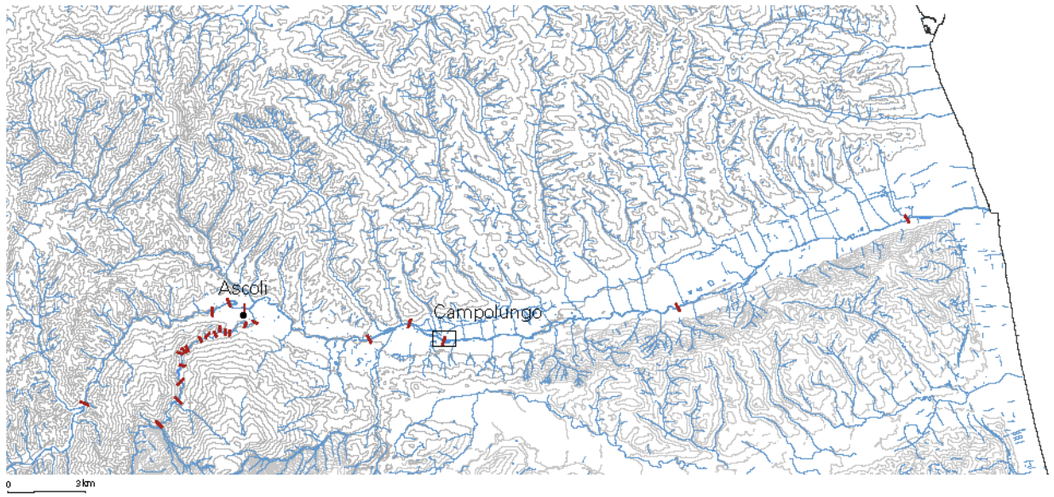
In order to prevent the washing away of usable land along the river, since 1900 checkdams and concrete canals are being errected. This holding back of sediments leads to a shortage downstream.

Building levees with new technologies

These special dams are built of two layers. Initially, cells of different materials are equipped with filters and filled up with vegetation soil. The next layer is a composite made from metal and a highly resistent bionet. Afterwards the net is vegetated with seeds. The cells which always lay in the water are filled with stones. After a few months the construction overgrows with plants.

Protecting bridges

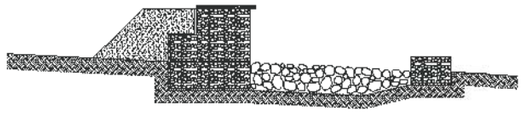
In order to moderate the rivers downcutting force, check dams are constructed downvalley of bridges. As a consequence, sediments are stored in the area of the bridges' foundation. In this way their stability is guaranteed (above: bridge near Campolungo).



artificial levees

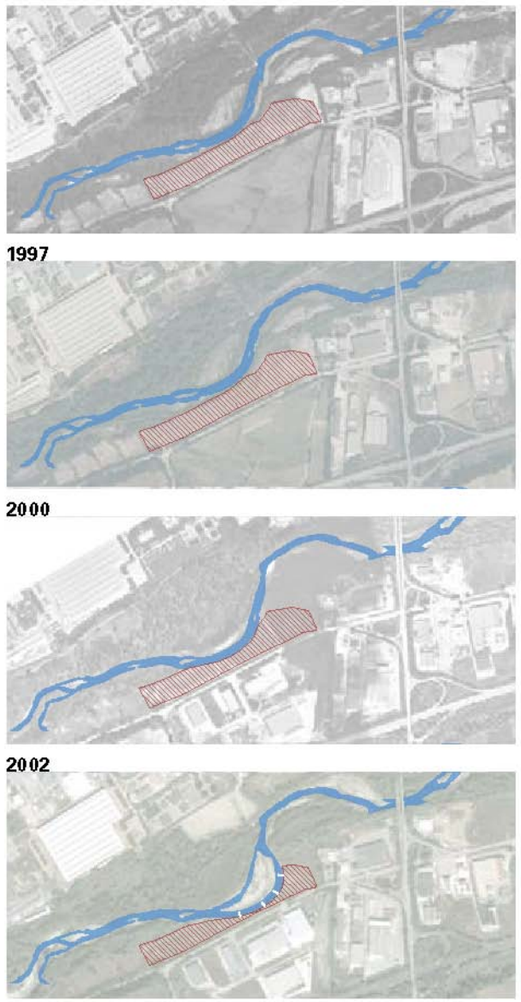
Check dams

Check dams are predominantly situated in the steep regions of the valley and next to bridges. Placed laterally to the course of the river, they aim on slowing down the torrential force of the river and on holding back sediments.



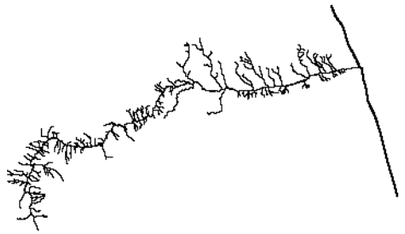
Construction of check dams

Check dams are constructed in the same manner as the gabbioni. Boxes are filled up with stones that allow a certain permeability, but at the same time slow the water down.

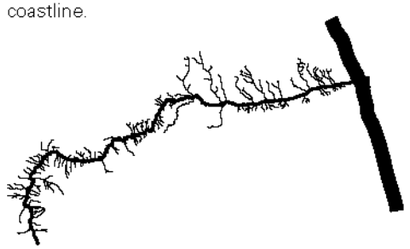


Efforts to subdue the river

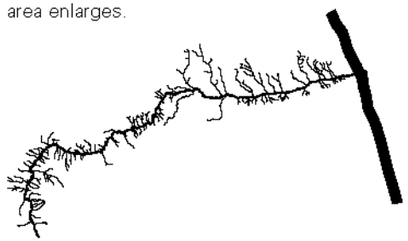
The naturally meandering river poses a threat to adjacent streets and buildings. Therefore, checkdams are placed along the bend (above and right: construction of check dams near Campolungo).



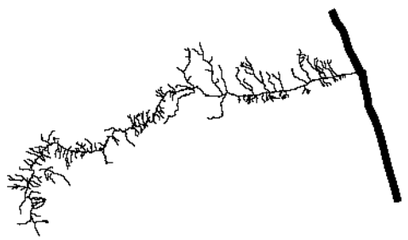
1000 AC: the stable sediment supply formed a rectilinear coastline.



1400: a papal declaration states that the land goes to these who first plough it. As a consequence deforestation induces strong soil erosion. The loose earth falls into the river and is transported to the sea. Therefore, the coastal area enlarges.



From 1900: efforts to reduce soil erosion like the 'alberata system' (type of tree cultivation) leads to shrinking of the coast.



1940 - 1960: extensive gravel extraction, concrete riverbeds for stabilisation and check dams that store sediments upstream drastidy reduce the sediment supply. The coast starts to retreat more rapidly.

The importance of sediments

COAST

As a consequence of deficient sediment supply by the rivers, the northern part of the Abruzzi Coast is eroding. This manifests itself by shrinking beaches. As touristic attendance in the area lies past its prime, attractive beaches are all the more an important allurement. For this reason elaborate actions are taken to either prevent or reverse the phenomena of coastal erosion, colloquially labeled as 'il mare mangia la costa'.

Delta of the Tronto river - Retreat of the coast line
01 1894
02 1948
03 1985
04 1999

2004

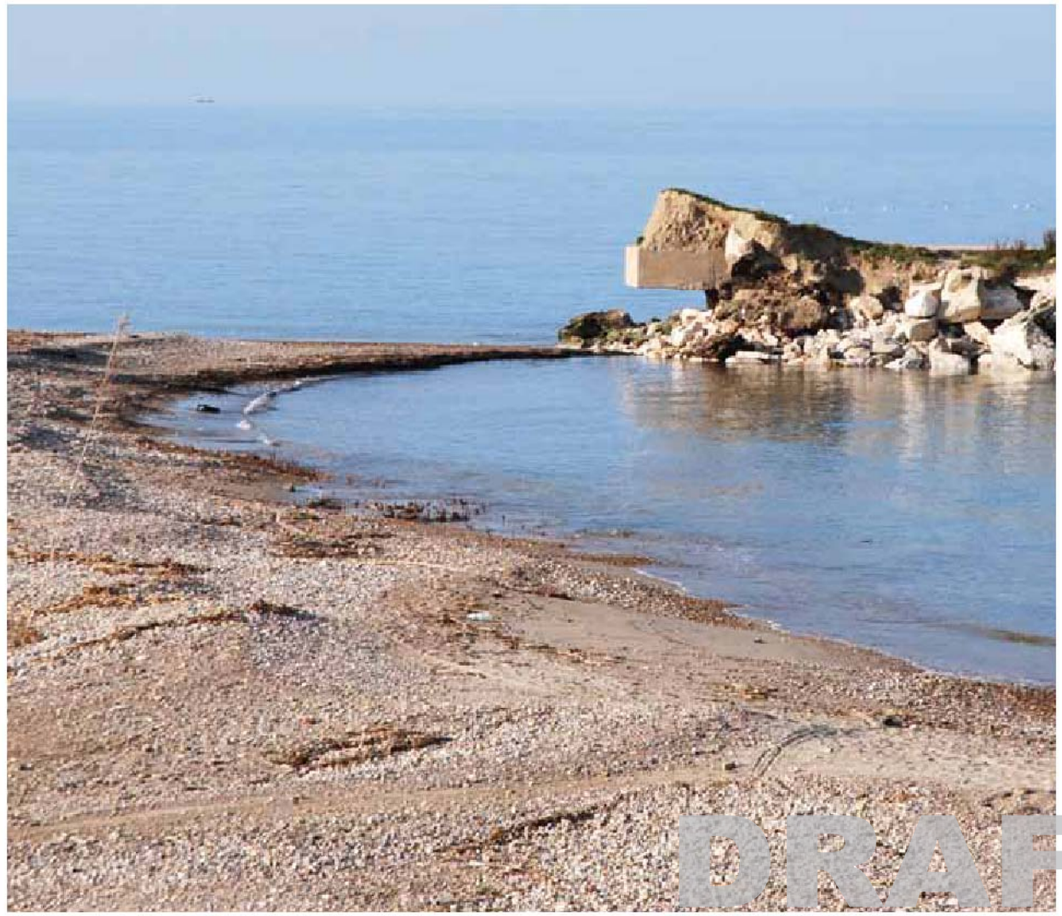
2006

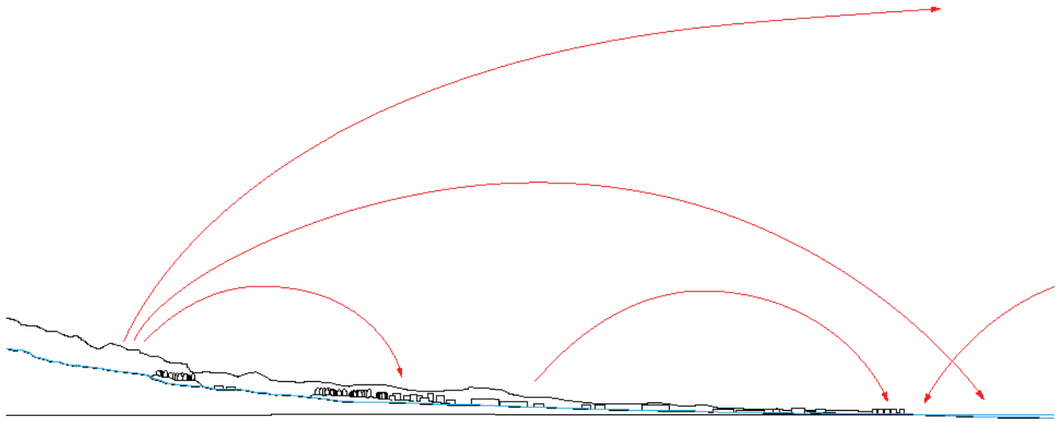
Disappearing beaches
2004 : the already thin beach near San Martino is used by a holiday colony and a camping ground.

2006: two years later, not only the beach but also the campside's infrastructures, such as the tenniscourt are affected.

"Mangia la Costa"

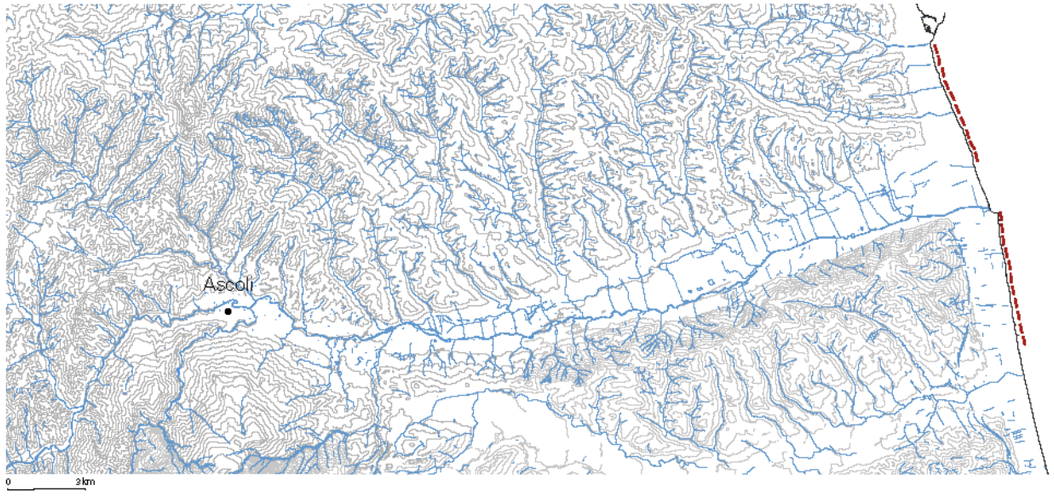
At the beginning of the 20th century the beaches of the area started eroding. The main reason is a reduced sediment supply by the rivers, caused by efforts to reduce fluvial land erosion upstream. This situation has later impaired trough the widespread extraction of gravel from the riverbed.





Shifting travertine

The stones that are used as wave breakers are travertine pieces of low quality taken from the quarries in the local mountains.



break water reefs

Prevention attempt

Since 1900, wave breakers are placed at the shore to weaken the eroding force of the waves. When the sand underneath them erodes, they sink below the water surface. For this reason second and third lines of stacks were erected.

01

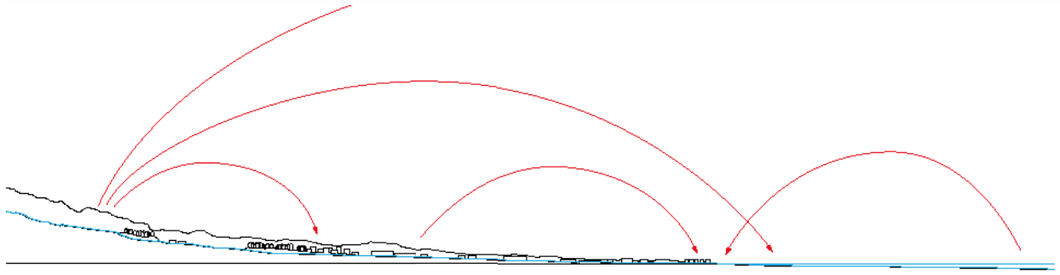
02

Travertine wave breakers

01 Almost every part of the coastline is protected by wave breakers. The space between the single stone accumulations is washed out (above: Coastline of Montesilvano Marina).
02 With a special cargo ship the stones are are heaped up to a stack.

The Beach: a necessity for tourism

While the beaches are deserted in the colder seasons, they are operated at full capacity during summer. Different renters manage individual sections.

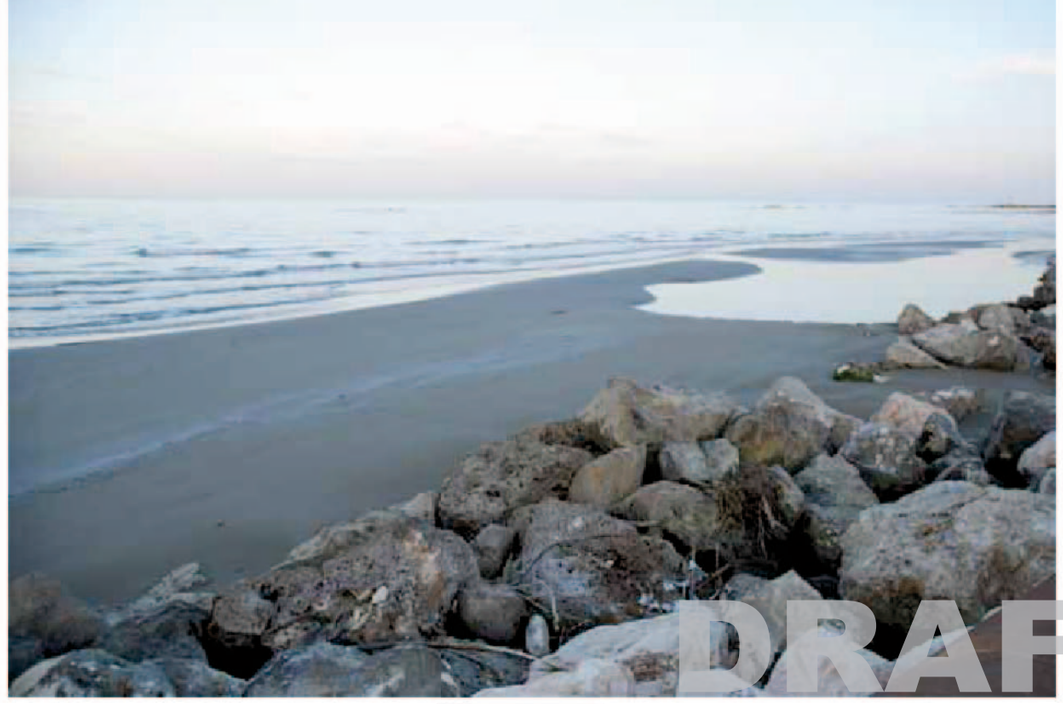


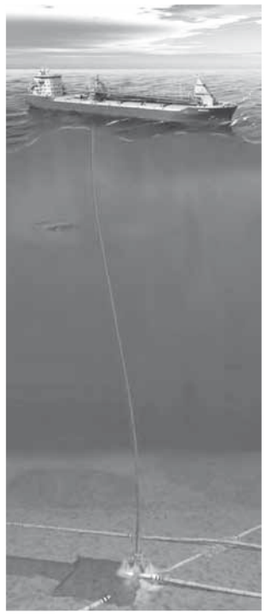
Shifting sand

The sand for the beach restoration is extracted off the shore of Ortona. Even tough this procedure states an intervention in marine life and especially effects the flora, the recovery dynamics happen surprisingly fast.

Artificial Beach

Since the measure of erecting wave breakers was insufficient, today whole beaches are being constructed artificially. 2009 a big poject started in which seven different water fronts are being restored. For this complex procedure Dutch experts are hired. The imported workforce alone amounts to 19 million euros.





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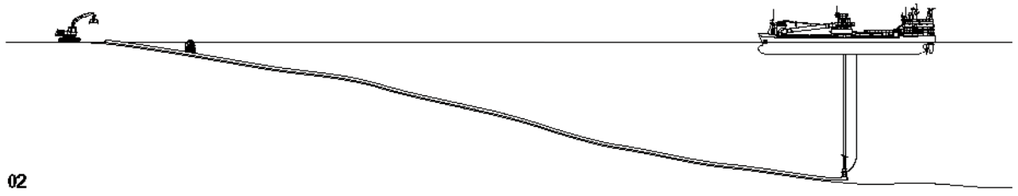
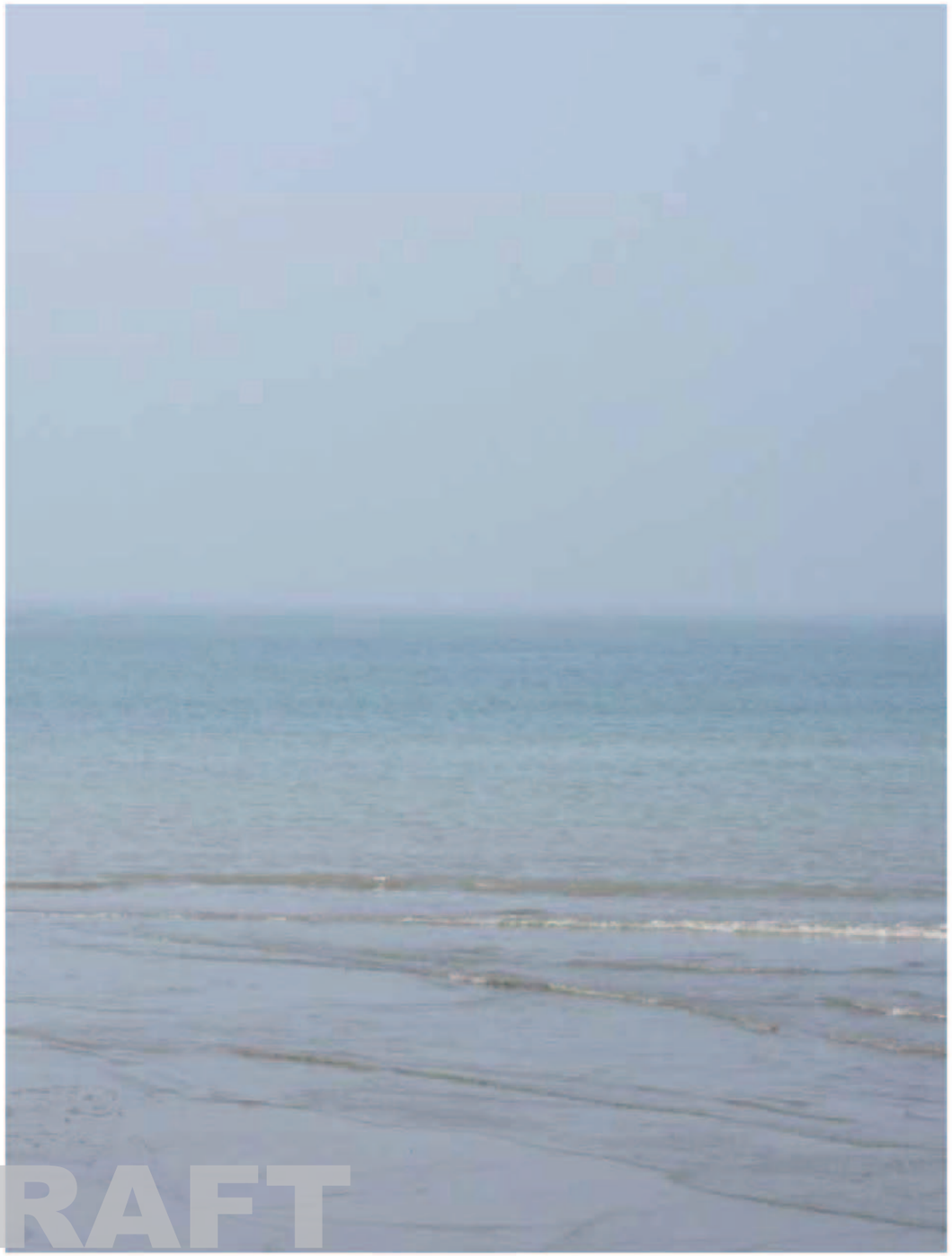


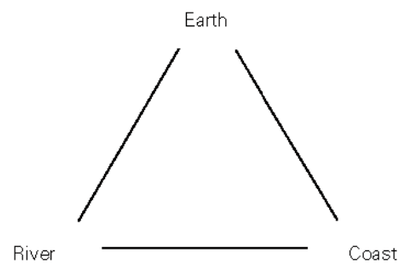
02

Technique

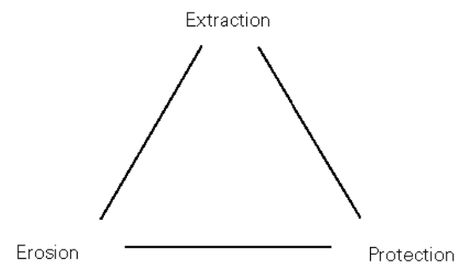
01 With the aid of tubes, freighters draw the required sand from the sea ground and transport it to the construction site. In order to stay sprayable the sand is mixed with water.
02 Off the coast the sand is pumped directly to its designated location. For the sand to settle on the shore, a calm sea is required.



ENTITY OF EARTH RIVER AND COAST



Morphological relationships in the territory



Relationships of transformation processes

Acceleration of territorial transformation

roman
- settlements on hilltops
- agriculture

middle ago
- deforestation
- agriculture
- erosion

1400
- settlements
- intensified deforestation
- ersoion

1863
- increasd sediment supply
- coastal plane formation
- alberata system

1940 - 1960
- railway, unification, gravel extraction, less sediment supply, shrinking coast

today
- industries, adriatic city, tourism, shift in landuse, highway, irrigation system, levees, check dams
- wave breakers, irrigation, protection, industry, sand, gravel, erosion, settlement, travertine, extraction, export, quarries, agriculture, mechanisation, streets
- railway, tourism, sediment supply, concrete, climate, check dams, artificial levees, concrete river beds, floods, shrinking, mangia la costa, highway
- artificial beaches, global acting companies, import of knowledge

Lanscape dynamism as a consequence

SOURCES

BOOKS

W. Fabietti, M.Morandi;
"Il Corridoio Adriatico"; Regione Abruzzo-Università, Gabriele D'Annunzio - Facoltà di Architettura; Àrgos Edizioni, Roma 1993

R. Mosè;
"Abruzzo verso una nuova immagine"; Quaderni Blu, n. 2; 1996

C.F. Black;
"Early Modern Italy, A social history"
Routledge, London, 2001

Annali Idrologici, 2003, Servizio Idrografico e mareografico di Pescara

V. Zamagni ;
"The economic history of Italy, 1860 - 1990",;
Oxford University Press; 1993

PAPERS

M.C. Dionnet,
"Recent evolution of land use systems in the Abruzzi region, Italy";
1985, Butterworth & Co Ltd, (p. 327-335)

M. Buccolini, B. Gentili, M. Materazzi, D. Aringoli, G. Pambianchi, T. Piacentini,
"Human impact and slope dynamics evolutionary trends in the monoclinal relief of Adriatic area of central Italy"; 2007, Catena 71, (p. 96–109); www.elsevier.com/locate/catena

M. Coltorti, P.Farabollini,
"Late Pleistocene and Holocene fluvial–coastal evolution of an uplifting area: The Tronto River (Central Eastern Italy)"
Quaternary International 189 (2008) 39–55

M. Coltorti,
"Human impact in the Holocene fluvial and coastal evolution of the Marche region, Central Italy", Catena 30 (1997) 311-335

R. Simonini, I. Ansaloni, Bonvicini Pagliai, F. Cavallini, M. Iotti, M. Mauri, G. Montanari, M. Preti, A. Rinaldi, D. Prevedelli
"The effects of sand extraction on the macrobenthos of a relict sands area (northern Adriatic Sea)";
Marine Pollution Bulletin 50 (2005) 768–777

S. Moretti, G. Rodolfi
"A typical "calanchi" landscape on the Eastern Apennine margin (Atri, Central Italy): geomorphological features and evolution"; Catena 40 2000. 217–228

Servizio Cartografico del touring club Italiano, Milano, 1989

DIGITAL MATERIAL

Piano Stralcio di Bacino per l'Assetto Idrogeologico del fiume Tronto, Autorità di Bacino Interregionale del Fiume Tronto, 2 CDs, (n.3 del 07/06/07)

Il Tronto: un parco attrezzato, Autorità di Bacino Interregionale del fiume Tronto, Convegno 2006, 1 CD

La Nuova Carta Tecnica Numerica, Abruzzo, 1 : 5'000
La Nuova Carta Tecnica Numerica, Marche, 1 : 10'000

INTERNET

http://www.maps-for-free.com/
http://cartanet.regione.abruzzo.it/
http://www.pcn.minambiente.it/mdSearch/
http://cartografia.regione.marche.it/
http://www.regione.abruzzo.it/xcartografia/
http://www.istat.it/

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P. 45
Coltorti, M. ; "Human impact in the Holocene fluvial and coastal
evolution of the Marche region, Central Italy" (p.329)

P. 64
http://www.vanoord.com/gb-en/our_company/download_centre/request_form_annual_report/index.php

P. 50, 52, 58, 62
http://maps.google.ch

P. 52
http://cartanet.regione.abruzzo.it/

P. 9
http://www.wikipedia.org

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INSTITUTIONS

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Universita'Degli Studi Di Camerino, Ascoli Piceno