Landscapes

Introduction

Natural landscape are the fruit of a delicate balance, created in geological times, between the various natural agents, the different forces, the different processes acting on the surface of and underneath the Earth's crust. It is not a static and immutable balance, but a "dynamic" one, where the processes interact with each other continuously, limiting or magnifying each other in turn. Each one of man's interventions affects this delicate balance, interfering with the natural processes, till when they are modified, at times in an irreversible manner. These forms of interference can be negative; and man, more or less knowingly, tends to trigger or amplify the geological processes that may turn out to be harmful. Through the analysis of the territory, in most of the cases it is possible to foresee the possible effects of man's interventions: landscape analysis is a very important instrument, in the defence of the territory and its rational and respectful exploitation of the natural processes.

Factors that shape

Observing the Earth's surface

Atmosphere and hydrosphere get in contact with rocks and minerals on the Earth's surface, where rocks spontaneously adapt to the conditions of our planet. The Earth's surface is continuously evolving and modifying in time to create different landscapes. The elements that characterize a landscape are various and range from soil conformation (grasslands and mountains) to water bodies (lakes, rivers and waterfalls), animals (fauna) vegetation (flora), climate and man's works (cities, roads, castles and many infrastructures). A natural landscape, without any human intervention, is often the result of two opposite forces, a battle that has been going on for thousands of years, between the geological processes that occur inside the Earth (the movement of earth plates, volcanic activity, the processes that lead to the creation of new mountains) and the processes that occur externally to the Earth's surface (erosion and water transport of material, changes due to particular climate conditions and many others).

Factors and shape

The Earth's crust is affected by tectonic movements that hit continents, close oceans, build mountains and make the Earth's surface less uniform.
In fact there are regions with very high mountains, while others are characterized by deep depressions, like ocean trenches.
The creation of a mountain or creasing of the Earth's surface is due to factors that act from inside the earth and are called endogenous agents. During the years, mountains and hills are eroded: slopes become less inclined while rock debris are deposited on the most depressed areas (sedimentary basins). This erosive action occurs continuously as a consequence of exogenous agents.
The shape and the characteristics of a landscape derive from its structure (rocks and minerals it consists of), the processes that shape the structure and the length of time a specific process takes to act on it. But it is necessary to consider the activities that men carried out on the territory, modifying its shape and characteristics and contributing to the creation of anthropic landscapes, "humanized", to be distinguished from the natural ones. Anthropic landscapes, in fact, represent the historical result of human culture and activities on nature.

Ocean floor

When we explore an ocean floor, we meet huge and long underwater mountain chains, where earthquakes occur and which are characterized by an intense volcanic activity. These long mountain chains (ocean ridges) stretch without interruptions all along the Atlantic, Indian, Antarctic and Pacific ocean, for a total length of 80,000 km. They are very big and fragmented mountains, with an approximate height of 3 km from the ocean floor and an approximate width of 1500

km. The highest part is called the rift valley. It is formed of a deep cut (like a long and narrow trench), surrounded by mountains and plateaux. This valley is a volcano that has a very intense activity and the rocks that originated from the lava solidification form the ocean crust. The new ocean crust forms the new ocean floor and the ocean becomes bigger. In some cases the new ocean ridge emerges from the ocean surface and forms volcanic islands like, for example, Iceland and the Azores.
The earth does not increase its volume since the ocean crust, that forms on the ridges, is consumed in another area. This is typical of oceans. This area is called ocean trench. Here the ocean crust submerges under the continental crust, as it happens near the Andean Cordillera and volcanic arches.

Volcanic heights

A volcano is an opening of the Earth's surface from where lava and gases come out at high temperatures. The structure of the volcano is the result of the continuous accumulations of erupted material, which then cools down. The following volcanoes have to be distinguished:

- linear volcanoes, that release large quantities of very fluid lava, that expands on wide areas. A typical example of them are Iceland volcanoes: long fractures that open on the ground
- cone-shaped volcanoes, that develop close to a circular conduct, from which the erupted material comes out directly. They are characterized by very steep slopes that originate immediately after the accumulation of lava fragments, ashes, lapilli, volcanic bombs (the so-called pyroclastic materials), which are violently expelled from the volcano mouth. In some cases, during volcanic activity, lava and pyroclastic materials are alternatively erupted. As a consequence, the so-called layered volcanoes are created, such as Stromboli and Vesuvio volcanoes in Italy
- shield volcanoes, which have very wide structures, such as those existing in Hawaii. Their base can be hundreds of kilometres wide and their slopes are not very steep.

The creation of mountains

The origin of mountains (orogenesis) occurs after tectonic movements make rock layers fold and overlap. All the Earth's surface, the lithosphere, is divided into rigid areas called continental plates and oceanic plates. These lithospheric plates continuously move and whenever they bump into each other, they form mountain chains.

How were the Andes created?

The Andes Cordillera started to form 250 – 200 million years ago after the crash between an oceanic plate (Nazca plate) and a continental plate (South-American plate). During the crash, the oceanic plate submerged under the continental plate. The movement and friction between the rock layers provoked earthquakes and a partial melting of the rocks. The melted rocks, less dense than the surrounding ones, move towards the higher part, as an air bubble would do when submerged into the water. In this way volcanoes are created, and melted rocks (magma) reach the Earth's surface. The Andes include numerous volcanoes that have formed two parallel mountain chains. The most internal and oldest chain is close to the ocean. The two chains are called Western Cordillera and Eastern Cordillera.

How was the Himalayas formed?

All big Asian chains, starting from Turkish mountains, to Iran, Afghanistan, Nepal, China, Sumatra and Java result from the crash between continental plates. In particular, the Himalayan chain formed after the crash between the Indian plate and the Euro-Asian plate that 30 million years ago were still separated by an ocean called Thetis. The plate collision, that started 45 million years ago, led to the disappearance of the ocean and the compression of rocks, which corrugated, folded and were lifted towards the top. The collision between the plates has not finished yet and Himalayan mountains are still lifting at a speed of 5 centimetres every year.
The Dead Sea, the Caspian Sea and the Lake of Aral are the remains of the Thetis Ocean, that disappear after the approach and crashing of the plates.

How were the Alps formed?

The Alps were formed after a crash between the Euro-Asian continental plate and the African continental plate, which were also separated by the Thetis ocean. In particular, 100 million years ago, the African plate changed its movement direction and went northwards with a speed of few centimetres a year. It compressed the rocks of the Thetis ocean crust against the Euro-Asian plate. The African plate moved like a huge bulldozer, scratching and piling up all the material that encountered during its journey. When the two continents crashed, part of the rocks that formed the ocean floor were trapped by the rocks that formed the continents and pushed to the top to form the Alps.
Subsequent and more complex movements occurred into different directions and led to the creation of the Apennines.

Change the shape of mountains

As a consequence of rain and storms, water fell in a more or less uniform way down the slopes and the rocky walls of the mountains, changing and breaking the rocks into many fragments. Those fragments fell towards the bottom of the mountains due to the force of gravity, forming piles of debris called debris layers.
Debris layers can be easily recognized at the bottom of rocky walls on the Dolomites.
Movements and landslides
Chemical alterations and the degradation of rocks on a slope facilitate the force of gravity. This leads to the slope moving fast or slowly towards the bottom of the mountain. Landslides are the rapid movement of compact rocks, debris masses, large quantities of clay and water or a mixture of mud, soil and rock debris. Landslides originate after or during intense rainy periods. Those slopes that are characterized by dry mud after a long period of draught absorb a big quantity of water after a prolonged rain. The muddy material becomes very fluid and heavy and moves at a speed of up to several kilometres an hour.
Landslides can be dangerous and have catastrophic consequences.

Climate and shape

All processes that shape the Earth's surface are interlinked and connected to climatic conditions. As a consequence, they are typical of some areas on the Earth. The Mediterranean area, the Polar area, the Tropical area, etc. are named morphoclimatic zones, and are characterized by particular exogenous and climatic factors.

Hot-wet regions

Hot-wet regions are characterized by plenty of water and high temperatures that provoke intense processes of chemical alterations. Their soil is rich in humus and covered by a dense green area that protects the land from river erosion and allows water absorption.
When the mountains consist of granitic rocks, the landscape is gentle and characterized by dome-shaped heights, called inselbergs. Inselbergs can be found isolated or in groups, without soil or vegetation cover. Instead, if the mountains are made of calcareous rocks, they look like pinnacles and towers and characterize the landscapes of Vietnam and Southern China.

Dry regions

There are two different types of dry regions:

- the area of tropical deserts and the savannah, which are characterized by a strong temperature range, lack of rain and absence of vegetation cover. Rock alteration is mainly due to temperature differences, as well as to the presence of dew and wind action. There are hollows, mushroom shapes and tafones, which are typical excavations at the bottom of the rocks created by wind action
- Antarctica belongs to dry regions because it is covered by perennial ice, humidity is extremely low and snow is the only precipitation. There are shapes created by wind action.

Mild regions

In mild regions, initially rainwater runs in a uniform way on the mountainsides and then it progressively collects along water streams. Distribution and intensity of rains vary according to the regions:

- oceanic regions are characterized by rain falls all year long and the soil has a continuous vegetation cover
- mediterranean regions are characterised by showers after the dry season. The vegetation cover is not continuous and it is degraded.

Rainwater that runs on the Earth's surface erodes the soil and forms a series of cracks of different dimensions. In particular:

- if the slope is very steep and is made of clay rocks, the cracks are deep and separated by crests, as the gullies on the Apennines
- if the land is formed of superficial fragments that are bigger than the ones underneath, the water forms deep cracks around the main rocks. With time passing earth pyramids form, which can reach 20-30 m height, and have the shape of a mushroom with a hat (a big rock) and a stem (made of finer compact material). We can observe earth pyramids in some places on the Alps and near the Lake of Iseo.

Periglacial regions

Rock fragmentation occurs as a consequence of ice action in the areas near the North Pole. Until 30 metres of depth the soil is frozen, but then it swells on the surface forming the permafrost.

Landscape's shape

The landscape around volcanoes

In volcanic regions the landscape is also characterized by a series of minor but very fascinating phenomena, like geysers in Iceland. They are fountains of extremely hot water that comes out directly from the ground and is pushed very high. In Italy, instead, fumaroles are very popular. They are emissions of gases and vapours originating from fractures on the volcanic structure. For example solfatares belong to this type of phenomenon. They are particularly popular in the Campi Flegrei areas, in Campania region. They develop especially when the volcano is almost extinct. They are emissions of water vapour, carbon dioxide and hydrogen sulphide that come out and deposit as sulphur on the surrounding surface. Also the boric-acid fumaroles in Tuscany are fumaroles that produce a vapour full of boric acid. And finally, it is necessary to mention thermal springs, which are also popular in Italy, and produce water that is very rich in hot gas, sometimes enriched with minerals.

River and lake landscape

As a consequence of rainfalls, the waters that runs on the soil surface forms a rivulet that, joining other rivulets, becomes a stream. While the stream runs towards the valley, it receives water from other rivers (tributaries) and runs into the track it has formed, which is called bed or riverbed.

The flow of a river has different gradients: the river is flatter as it gets towards its mouth. Suddenly, the gradient can increase if the riverbed is made of more compact and non-erodible rocks. In these areas rapids form and if the bed has a vertical gradient, waterfalls form.

Abandoning the steepest part of its flow, and entering the flat area, the river current becomes slower and a part of the transported materials deposit: in this way a floodplain is formed. In these wider areas the river can become more meandering: it can form bends or serpentines, which are called meanders. The river flows into a lake or into the sea.

River erosion

Water, while running, manages to shape the landscape, since it erodes the rocky surface it runs on, it incorporates the

eroded fragments, transports and deposits them when it gets to the valley. The erosive capacity of water depends on its speed, and it is higher when the riverbed is more inclined and during floods. The river water and current transport a mixture of organic and inorganic substances, as well as salt. They also transport clay, slime and sand particles, while big bits of sand, gravel and stones roll on the riverbed.
This form of erosion is called abrasion and creates typical shapes:

- Potholes: when the current is more powerful, the river manages to dig some cracks that gradually become deeper (see image “Potholes”)
- Ravines, narrow and deep incisions that are created by the river on a compact rock, that keep vertical walls stable. Those incisions that become wider towards to top part are called gorges. Some examples are: the gorges of Alcantara, at the bottom of Etna mountain, or the fascinating Grand Canyon in the United States (See image “Ravines and Gorges);
- River valley: by constantly carving its own bed, a water stream digs a deeper and deeper crack until it shapes a valley. This represents a wide and deep depression of the Earth’s surface, and is limited by two mountainsides.

The shape of rivers
Watercourses are classified according to the shape of their flow:

- Plaited: they are formed of numerous and small canals that separate and re-join once they arrive at the valley. In these cases the river transports big quantities of sand and gravel. This is typical of dry, semi-dry areas and piedmont areas. In Friuli region, in the northern Veneto plain, watercourses are named grave (like Tagliamento, Medusa and Cellina when they arrive at the plain)
- Straight: watercourses with this shape are very rare and are normally located close to faults and where different types of rocks are located.
  With meanders: the water flow is narrow and with frequent curves on flat land. The movement of meanders and the slime and sand that deposit during floods form floodplains, like the Po plain.

The river flows into the sea
When a river gets to the sea, sometimes it manages to scatter the transported material. In this case an estuary is formed, like the river Thames.
When the river deposits the transported material on its mouth, a river delta is formed.
The Nile, that flows into the Mediterranean, and the Mississippi river, that reaches the gulf of Mexico, shape the coast forming a delta with several river branches. The delta of Tevere river, that flows into the Mediterranean sea, is modelled by the waves and sea currents and has a pointed shape. Instead the Seine, that reaches the English Channel, is shaped by sea tides and forms an estuary.
The delta of large rivers can extend for several thousands of square kilometres, according to the quantity of debris that are transported by the river and deposited close to the sea. A delta landscape (a river delta) is characterized by canals, lagoons, islands and isolated water basins.
Lakes
Lakes fill the depressions of the Earth’s surface and have a limited duration in time. They can be classified as:

- River lakes, when a river plain is flooded or a river branch completely separates from the river
- Barrier lakes, when a landslide or a lava flow interrupts a river flow. They can also originate from the deposit of rocky materials that are transported by a glacier

- Tectonic lakes form on depressions that are created after movements of the Earth's crust. Examples of them are the Dead sea (the most salty in the earth), the Bajkal lake (the deepest lake, 1741 metres), the lakes that occupy the Rift Valley in Africa, and the Caspian sea (an old sea that has been left isolated)
- Crateral lakes form inside extinct or exploded volcanoes like: the lake of Bolsena, Vico, Bracciano, Albano and Nemi
- Karstic lakes when, above carbonate rocks, there is a layer of clay that makes the rocks waterproof like the Lake of Scuatari in Albania
- Artificial lakes are built by men to collect irrigation water or to produce energy.

The evolution of a lake and the marshland

Lakes do not have a long life because they tend to be filled with sediments and be invaded by the vegetation. The first transformation is the creation of a pond, which is quite shallow. Later, a marsh is formed. The marsh is a land that is covered by a thin layer of water. These waters can be rich in natural substances that favour vegetation growth. Algae, canes and floating plants are typical of this kind of landscape. They decorate the whole water surface.

Karst landscape

The word karst derives from the name of a region, the Carso, at the border between Italy and Slovenia, which is characterized by this type of landscape. Karstik environments develop in places with calcareous rocks, which are highly soluble like limestones, dolomites and evaporitic rocks. Carbonates and evaporites are rocks made of minerals that are very soluble in the water and for this reason they are easily shaped by rainfalls. Also raindrops manage to melt these rocks and dig holes, sometimes very deep ones. The erosion of calcareous rocks in a Karstik territory is called corrosion.

The soil

The dark red colour of karstik soil is due to oxides and the clay content of calcareous rocks. When soluble minerals are melted by water and detached from the rock, some residual deposits are left on the spot. They consist of insoluble minerals, like iron oxides and clay minerals.

Superficial shapes

The most evident superficial phenomena are dolines: funnel-shaped depressions, 1-30 metres deep and hundreds of metres wide. The continuous action of water can favour the widening and union of several nearby dolines. In this way a single depression is formed, which is called uvala. A continuous corrosion leads to the creation of a wider and wider depression, on a flatland, called polje. These depressions can host small lakes that still have some little protuberances of harder and un-dissolved rocks.

Polje can be seen in the Italian and Slovenian Carso, where they are called piani or campi, like campo Imperatore on Gran Sasso.

The karstik landscape that we can see has no stable hydrographic network, with a total absence of water streams or rivers. The water, by dissolving carbonate rocks, digs the subsoil, where it creates typical underground shapes.

Underground shapes

In large karstik landscapes there are no rivers or streams running on the surface. Water streams run deep underground and, after spending some time underground, they come back to the surface. The underground karstik cavities are made up of caves and canals that can host underground water streams. An example of them is the Timavo river, in Carso in Trieste area: after running on the surface, close to San Canziano, the river goes underground and re-emerges 40 kilometres afterwards, near Monfalcone.

The walls of caves that no longer host rivers are full of juts and encrustations. The most famous are stalactites that hang from the ceiling, and stalagmites that lift from the cave floor. The two protuberances, with time, can join and form columns.

Glacial landscape

A glacier is a moving mass of ice. This movement has an erosive action that shapes the Earth's surface in cold regions. In the history of the Earth, during the Quaternary period, almost a fourth of the lands that had emerged from the sea were occupied by icecaps. Icecaps stretched to the northern regions of America, Europe and Asia that today are characterized by a mild climate. They were thousand of metres thick. When glaciers started to move forward, they deeply modified the land surface, changed river flows, stopped vegetation growth and forced animals to withdraw towards southern regions. During the hottest periods, the ice withdrew to the north, leaving deposits of the materials that they were transporting on the land. The regions that got free from the ice were now covered by forests and populated by animals, but kept the traces of erosion and accumulation of glacier materials.
Examples of erosion and accumulation and glacial landscapes can be seen nowadays on the Alps and the Himalayas.

Glacial erosion

The downward movement of a glacier acts on the rocks that compose the land as if it was a bulldozer: it collects and transports various blocks, of different sizes. At the end of a glacier there can be a watercourse, which exercises an erosive action on the underlying rocks, like any other river that runs on the surface. The result, once the glacier has withdrawn, are smooth rocks and cracks and grooves on the rocks. The land irregularities are reduced and the rocks look like flat humps: roche mountonnée. By observing these rocks geologists can re-build the history of the territory, since according to the hump direction it is possible to understand the direction the glacier moved to.
In an Alpine landscape, the main and the secondary valleys are shaped by the glaciers action that has eroded the valleys and the mountainsides. These valleys have a U-shape, while those valleys that have been created exclusively by the action of a watercourse or a river are narrow and have a V-shape. Glacial valleys, on the top, have a semicircular shape, which is occupied by a small glacier or a small lake surrounded by steep rocky walls. This is the glacial cirque, the place where the snow piles up. That snow is later transformed into the ice that feeds the glacier. When the depositing snow is more than the snow that melts during the hot periods, the glacier grows and moves towards the valley.
Some typical glacial valleys were invaded, after their creation, by ocean waters. They are called fjords (they are typical of Norwegian coasts). Fjords are U-shaped valleys that were carved by the glaciers that had run down from the nearby mountains during the ice periods. During those periods, the sea level was lower than today. A big quantity of water at that time existed as ice. The following ice melting provoked an increase in sea level. The water invaded the valleys near the coasts.

Types of deposits: moraines

When the ice of a glacier melts and disappears, it leaves the transported rocky material on the ground and forms:

- Moraines, formed by the debris coming from the glacier surface;
- Floor moraines, formed by the debris that came from the glacier floor;
- Erratic blocks, that are very big and weigh some tons. They are transported for hundreds of kilometres and left on completely different rocks. When geologists find a rock that is completely different from the near ones, they understand that in ancient times that rock was transported and deposited by a glacier.

The information that can be conveyed by moraines and erratic blocks is very important, as it helps us reconstruct the events and the climate of past geological periods. Moraines indicate the shape, help us reconstruct the movements and the maximum dimension reached by the glacier. It is very important to study hills and small moraines that are present in the Plain of the Po, as they show that the area was covered by icecaps.

Aeolian landscape

The dry regions of the Earth are the most exposed to wind action, which blows in a regular way and with a speed that can range from few kilometres an hour to 200 kilometres an hour in case of a hurricane or a typhoon. Compared to water, the wind transports lighter fragments: sands and silts are transported by wind that exceeds 30-40 kilometres an

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hour. Trees, bushes and grass create obstacles to the wind. Also the presence of water makes soil particles heavy and hinders their transport.
Very fine particles are kept in continuous suspension by the wind that lift them very high and keeps them high for days, weeks or months and then deposits them far away. Saharan fine sands are transported by the wind towards the Mediterranean Sea until they fall down on the Plain of the Po when it rains. The result of this process is the red sand that falls on cars. Sand, silt and clay particles are dragged and rolled by the wind, that makes them jump 1-2 metres high. When the wind removes fine materials from the soil surface, this results in gravel deserts, made of gravel, stones and big blocks. These materials together form the desert floor.

Wind erosion

The sandy particles that are more easily transported are those made of quartz minerals. Quartz is a very hard mineral, which erodes the rocks close to the ground and the materials it encounters (for example telephone and electric poles). The result is the creation of grooves and slots on clay rocks, while rocky walls and soil blocks are smoothed.

Particles deposited by the wind

When the wind stops or reduces its speed, the transported material is deposited. The sands pile up as dunes, which can be 10-100 metres high. Dunes are never isolated, but they are grouped and form dune fields that move as the wind pushes them. When, as a consequence of environmental and climatic change, dunes are covered by vegetation, they acquire a fixed shape and position.
Thin sands are transported by the wind from desert regions to far away places. They deposit onto several layers and form the loss. Deposits of loss can be found in central-northern Europe, Chile and North America.

Deserts and desert regions

Desert regions are characterized by draught, and water streams are called uadi: they are almost always dry, because the water evaporates or filters into the subsoil before reaching the sea. When the water collects into a depression, it evaporates and leaves layers of evaporitic rock sediments. In this way the chotts form. They are “salt deserts”, located in Tunisia. Or the playa of California desert is formed. Or a black layer is created due to water evaporation and oxidation of the salts that are contained in the desert minerals. This is called desert paint.
A desert cannot be completely flat. It can have heights and steep slopes, with a debris base, without vegetation. Characteristic of desert landscapes are the wide plateaux called mesa or meseta (what is left of a wide eroded flat area) and buttles (tower-shaped heights).

Coastal landscape

he coast is a strip of soil between the mainland and the sea. The coast is constantly shaped by the action of the sea (waves and tides), the wind and atmospheric agents. We do not have to forget that some organisms, such as corals and algae, can destroy or build a part of the coastal landscape. Coasts can be low or high, rocky or sandy. High and rocky coasts are characterized by steep cliffs whose base is excavated by the waves. This can favour the collapse of the higher walls and therefore the withdrawal of the coast. Typically, this landscape is characterized by bays and creeks that facilitate the construction of ports. The most typical shape of low coasts is a beach, made up of stones in the most internal part and sand that becomes finer and finer towards the sea. The waves and the material that is deposited on a river mouth manage to constantly pile up debris close to the coast, by forming borders, barriers, banks and shores.
The different types of coast are:

- high coasts with cliffs: they are characterized by a vertical rocky slope straight on the sea (ie. Coasts of Normandy, English coasts on the English Channel, coasts of Scotland and Ireland). At the bottom of the walls the waves carve some deep cracks that form spectacular shapes like arches, rocks and caves. The cracks can be quite deep and provoke the collapse of the rocky wall. In this way the cliff wall withdraws. Coasts are not only shaped by the action of the sea, but they are also shaped by tectonic movements of the Earth’s crust and by sea movements. In fact, we can find some sea caves that are now located tens of metres above the current

sea level, while others are completely submerged. Examples are the sea caves of Circeo, of the channel of Otranto, Capo Palinuro, Capri, Sardinia and Liguria;

- rias coasts: they originated as a consequence of the sea invading old river valleys. The heights form peninsula and capes. Examples are Galicia, western Corsica, central-southern Greece. Deep gulfs and creeks that host ports are typical of this type of landscape. Old valleys that were occupied by glaciers and that are now invaded by the sea have formed the fjords, while the skjars (rocks garden) are coasts formed of several small islands and rocks. They are typical of Finland and Sweden;

- low coasts: they form when the destructive action of the sea is weaker and the river material settles. This material is distributed along the coast by weak sea currents and deposited on shallow waters, in areas that are protected by promontories. Waves move these deposits by forming long submerged piles that gradually emerge from the sea surface in order to form sandbanks and the typical beaches with a tongue or arrow shape that extend from the promontories. These beaches can stretch more and set the borders of the bay, forming a lagoon. The evolution of the lagoon into a coastal lake occurs when there is a complete separation from the sea (Lakes of Lesina and Varano in Puglia region). Tombolos are created when sand strips connect the island with the mainland (Argentario mountain and Orbetello ponds). Beaches are a typical deposit of low coasts.

Lagoons

A lagoon is a stretch of sea, often some kilometres wide, with shallow waters and a low and sandy coast. The lagoon can be connected to the open sea by canals that facilitate water exchange and the lagoon cleaning. Usually, with time passing, the canals close and form coastal lakes. These small lakes are gradually filled with river material. Among the most famous lagoons in the world is the lagoon of Venice, located between the Po delta and Piave mouth.

Industrial landscape

Industrial landscapes are obviously typical of those areas where industrial activities are very intense. Therefore it is necessary to make a distinction between industrialized and poorly-industrialized countries. The latter are located in the so-called South of the world. They are scarcely developed and their populations live in poverty. Instead, the North of the world is populated by highly industrialized countries, the rich ones, i.e. North America, Western Europe, Japan. Also Australia and New Zealand can be included in this group.

The north, more developed, hosts ¼ of the world population, but owns 80% of global incomes and 90% of the industrial production. Between the north and the south are all those countries (Hong Kong, Taiwan, Singapore, Brazil and Mexico) that, in the latest years, have experienced a gradual industrialization process. These countries, in order to reach a higher industrial

development, exploit their raw materials and low-cost labour force.

Agricultural landscape

As agriculture is the first human activity, agricultural landscapes are spread in all continents and populations. Like the industrial landscape, agricultural landscapes are not equally distributed between the developed and underdeveloped world. North America and Europe are characterized by a wide presence of rural landscapes, with intensive agriculture. In these areas, large agricultural fields are subject to a periodic rotation of crops. In this way, by using modern equipment, huge quantities of produce are exported and devoted to industrial production. Also animal farming is very developed: it represents the main economic support for Denmark and Ireland.

Instead, in most of African, Asian and South American countries, agriculture still represents a subsistence activity. Agricultural production, obtained with primitive techniques, only manages to satisfy the needs of few people. Moreover, travelling agriculture is very popular. It is a very precarious activity, which is also very dangerous for the landscape. It is based on the deforestation of surfaces, after setting the vegetation on fire. Subsequently, the soil is farmed but, as it is not taken care of, nor fertilized, it becomes sterile and it is abandoned. In these countries monoculture is very developed.

Wide lands are farmed with a determined type of plant, generally the most requested for exports. This, of course, impoverishes the heterogeneity of the landscape.

Environment and territory

How man modifies the environment

The environment is a system whose processes are continuously interacting with the organisms that live in it. We have seen, for example, that rainwater changes the Earth's surface, and that vegetation plays an important role in rock disintegration and soil formation. There are many human beings in the environment. Man is the only individual to be able to build and use equipment that can modify the landscape in a very short time. Nature would take thousands of years to produce the same changes as the ones produced by man. Human activities on the environment strictly depend on the type of economic activity and how society is organized. In some cases human activities aim at recovering environmental upheaval. As a consequence, man can be considered as an important landscape-modifying agent.

The construction of big works

The building of dikes, piers, roads, energy plants, etc. modifies the landscapes and interferes with natural processes. These changes have to be kept in mind during the first planning stages.

Let us image to stop a river flow by building a dike. We will have to take the following aspects into consideration:

- the stability of the building;
- the quantity of river sediments that will not reach the sea but that will deposit on the dike lake;
- the danger of erosion for the beaches that are located close to the river mouth.

The accurate study about the environmental compatibility of a building during its design is called assessment of environmental impact.

Surface water erosion

In order to stop surface water erosion it is necessary to reduce water speed. At this regard and in order to protect a riverbed, men build river bridles, i.e. a series of steps along the river flow. In order to prevent floods, instead, artificial banks are built. When building them, it is important to calculate the natural space the river needs in order to let floodwater drain off.
In order to reduce the quantity of water of a riverbed during a flood, water tanks (that can provisionally transmit a certain quantity of water) and drainage channels (that divert the river flow) are designed.

How to protect from landslides

Landslides provoke serious damages to things and people and they can be prevented by consolidating the area at risk. First of all it is necessary to detect the sliding land and avoid building or excavating in the area. Moreover, it is necessary to prevent big quantities of water from running on the surface of this land: drains have to be built and vegetation growth is to be encouraged. Support walls or gabionades are built to contain material that otherwise would move to the bottom of the slope.

Vajont landslide

In 1957 a dike in the Vajont river started to be built. Above the dike a lake was formed and geologists highlighted that the mountainsides that surrounded it were not stable: the sedimentary rocks on the sides were set on poorly compact layers of clay. After a first landslide, on 9th October 1963, 300 million cubic metres ran from the Toc Mountain to the lake and provoked a wave of 40 million cubic metres of water that went over the dike. The effects were devastating since the wave swept Longarone village and other villages away. In this case human responsibility is obvious, as the geologists' studies were not taken into consideration, nor during the dike designing stage or after the first landslides.

Environmental Impact Assessment

The Environmental Impact Assessment was born in the United States in 1969 from the National Environment Policy Act (NEPS) and it anticipated, by almost ten years, the basic principle of the concept of Sustainable Development, defined as a “sustainable economic development that meets present needs without compromising future generations ability to meet their own needs” enunciated by the World Commission on Environment and Development, Our Common Future, in 1987.
In Europe, this procedure was introduced by EEC Directive 85/337/EEC (Council Directive dated 27 June 1985, on the Assessment of the Effects of Certain Public and Private Projects on the Environment), and was subsequently implemented in the regulations of the Member States, soon becoming a fundamental instrument in environmental policies.
EIA is a study that evaluates the consequences that a project will have on the territory and on its inhabitants. The examined territory must not only include the areas that are in the immediate vicinity, but it must include all the areas that are near and far, that may feel the impact of the project on the environment in some way.
Environmental Impact Assessment Studies must provide competent authorities the elements for them to decide, as follows:

- Global environment and Project description stage, which also includes atmosphere, hydrosphere, biosphere and anthroposphere;
- Identification and assessment stage, of the impacts of the project on the environment, such as interferences and environmental components;
- General assessment stage, by the party proposing the project or intervention, after having defined the chosen methods and criteria.

EIA is also a process in which the citizens participate, and in this way are informed of the complex environmental and social condition. This enables citizens to control the coherence and the efficiency of the work carried out by the competent authorities and enrichen the decision-making process, with their observations.

Floods

In Italy watercourses are often characterized by dry periods and short but intense floods due to heavy precipitations. The water rise provokes an increase in the water running speed. As a consequence, the water goes out of its banks. Deforestation, fires, buildings in risky areas are some of the reasons why these phenomena occur.
The waters of the Po river run inside the artificial banks that stretch for 510 km, out of 652 km of the river total length. In this way the danger of sudden floods increases, the water goes over the artificial banks and invades the nearby areas by provoking serious damages to agriculture and inhabited centres.