Plate I - Synoptic Table of ESI 2007 Intensity Degrees - The accuracy of the assessment improves in the higher degrees of the scale, in particular in the range of occurrence of primary effects, typically starting from intensity VIII, and with growing resolution for intensity IX, X, XI and XII. Hence, in the yellow group of intensity degrees (VIII-X) the effects on natural environment are an essential component of seismic intensity that cannot be disregarded. In the orange group of intensity degrees (XI-XII) they become the most effective tool for intensity assessment.

- Quadro sinottico dei Gradi di Intensità della scala ESI 2007 - L'accuratezza della valutazione aumenta verso i gradi più alti della scala, in particolare nell'intervallo di occorrenza degli effetti primari che tipicamente iniziano a manifestarsi dall'VIII grado con risoluzione crescente fino al XII grado. Pertanto, per i gradi di intensità in giallo (VIII-X) gli effetti sull'ambiente naturale sono una componente essenziale dell'intensità che non può essere ignorata. Per i gradi di intensità in arancio (XI e XII), essi sono lo strumento più affidabile per la valutazione dell'intensità.

		PRIMARY EFFECTS	SECONDARY EFFECTS								
		Surface faulting and deformations	Hydrological anomalies	Anomalous waves/tsunamis	Ground cracks	Slope movements	Tree shaking	Liquefactions	Dust clouds	Jumping stones	TOTAL AREA
From I to III		There are no environmental effects that can be used as diagnostic									
IV	**LARGELY OBSERVED** **First unequivocal effects in the environment**	Absent	Rare small variations of the water level in wells and/or of the flow-rate of springs are locally recorded, as well as extremely rare small variations of chemical-physical properties of water and turbidity in springs and wells, especially within large karstic spring systems, which appear to be most prone to this phenomenon.	In closed basins (lakes, even seas) seiches with height not exceeding a few centimeters may develop, commonly observed only by tidal gauges, exceptionally even by naked eye, typically in the far field of strong earthquakes. Anomalous waves are perceived by all people on small boats, few people on larger boats, most people on the coast. Water in swimming pools swings and may sometimes overflows.	Hair-thin cracks (millimeter-wide) might be occasionally seen where lithology (e.g., loose alluvial deposits, saturated soils) and/or morphology (slopes or ridge crests) are most prone to this phenomenon.	Exceptionally, rocks may fall and small landslide may be (re)activated, along slopes where the equilibrium is already near the limit state, e.g. steep slopes and cuts, with loose and generally saturated soil.	Tree limbs shake feebly.	Absent	Absent	Absent	------
V	**STRONG** **Marginal effects in the environment**	Absent	Rare variations of the water level in wells and/or of the flow-rate of springs are locally recorded, as well as small variations of chemical-physical properties of water and turbidity in lakes, springs and wells.	In closed basins (lakes, even seas) seiches with height of decimeters may develop, sometimes noted also by naked eye, typically in the far field of strong earthquakes. Anomalous waves up to several tens of cm high are perceived by all people on boats and on the coast. Water in swimming pools overflows.	Thin cracks (millimeter-wide and several cms up to one meter long) are locally seen where lithology (e.g., loose alluvial deposits, saturated soils) and/or morphology (slopes or ridge crests) are most prone to this phenomenon.	Rare small rockfalls, rotational landslides and slump earth flows may take place, along often but not necessarily steep slopes where equilibrium is near the limit state, mainly loose deposits and saturated soil. Underwater landslides may be triggered, which can induce small anomalous waves in coastal areas of sea and lakes.	Tree limbs and bushes shake slightly, very rare cases of fallen dead limbs and ripe fruit.	Extremely rare cases are reported of liquefaction (sand boil), small in size and in areas most prone to this phenomenon (highly susceptible, recent, alluvial and coastal deposits, near-surface water table).	Absent	Absent	------
VI	**SLIGHTLY DAMAGING** **Modest effects in the environment**	Absent	Significant variations of the water level in wells and/or of the flow-rate of springs are locally recorded, as well as small variations of chemical-physical properties of water and turbidity in lakes, springs and wells.	Anomalous waves up to many tens of cm high flood very limited areas nearshore. Water in swimming pools and small ponds and basins overflows.	*Occasionally, millimeter-centimeter wide and up to several meters long fractures are observed in loose alluvial deposits and/or saturated soils; along steep slopes or riverbanks they can be 1-2 cm wide. A few minor cracks develop in paved (either asphalt or stone) roads.*	Rockfalls and landslides with volume reaching ca. 10^3 m^3 can take place, especially where equilibrium is near the limit state, e.g. steep slopes and cuts, with loose saturated soil, or highly weathered / fractured rocks. Underwater landslides can be triggered, occasionally provoking small anomalous waves in coastal areas of sea and lakes, commonly seen by intrumental records.	Trees and bushes shake moderately to strongly; a very few tree tops and unstable-dead limbs may break and fall, also depending on species, fruit load and state of health.	*Rare cases are reported of liquefaction (sand boil), small in size and in areas most prone to this phenomenon (highly susceptible, recent, alluvial and coastal deposits, near surface water table).*	Absent	Absent	------
VII	**DAMAGING** **Appreciable effects in the environment**	Observed very rarely, and almost exclusively in volcanic areas. Limited surface fault ruptures, tens to hundreds of meters long and with centimetric offset, may occur, essentially associated to very shallow earthquakes.	Significant temporary variations of the water level in wells and/or of the flow-rate of springs are locally recorded. Seldom, small springs may temporarily run dry or appear. Weak variations of chemical-physical properties of water and turbidity in lakes, springs and wells are locally observed.	Anomalous waves even higher than a meter may flood limited nearshore areas and damage or wash away objects of variable size. Water overflows from small basins and watercourses.	*Fractures up to 5-10 cm wide and up to hundred metres long are observed, commonly in loose alluvial deposits and/or saturated soils; rarely, in dry sand, sand-clay, and clay soil fractures are also seen, up to 1 cm wide. Centimeter-wide cracks are common in paved (asphalt or stone) roads.*	Scattered landslides occur in prone areas, where equilibrium is unstable (steep slopes of loose / saturated soils), while modest rock falls are common on steep gorges, cliffs). Their size is sometimes significant (10^3 - 10^5 m^3); in dry sand, sand-clay, and clay soil, the volumes are usually up to 100 m^3. Ruptures, slides and falls may affect riverbanks and artificial embankments and excavations (e.g., road cuts, quarries) in loose sediment or weathered / fractured rock. Significant underwater landslides can be triggered, provoking anomalous waves in coastal areas of sea and lakes, directly felt by people on boats and ports.	Trees and bushes shake vigorously; especially in densely forested areas, many limbs and tops break and fall.	*Rare cases are reported of liquefaction, with sand boils up to 50 cm in diameter, in areas most prone to this phenomenon (highly susceptible, recent, alluvial and coastal deposits, near surface water table).*	Absent	Absent	The total affected area is in the order of **10 km²**.
VIII	**HEAVILY DAMAGING** **Extensive effects in the environment**	Observed rarely. *Ground ruptures (surface faulting) may develop, up to several hundred meters long, with offsets not exceeding a few cm, particularly for very shallow focus earthquakes such as those common in volcanic areas. Tectonic subsidence or uplift of the ground surface with maximum values on the order of a few centimeters may occur.*	Springs may change, generally temporarily, their flow-rate and/or elevation of outcrop. Some small springs may even run dry. Variations in water level are observed in wells. Weak variations of chemical-physical properties of water, most commonly temperature, may be observed in springs and/or wells. Water turbidity may appear in closed basins, rivers, wells and springs. Gas emissions, often sulphureous, are locally observed.	Anomalous waves up to 1-2 meters high flood nearshore areas and may damage or wash away objects of variable size. Erosion and dumping of waste is observed along the beaches, where some bushes and even small weak-rooted trees can be eradicated and drifted away. Water violently overflows from small basins and watercourses.	*Fractures up to 50 cm wide and up to hundreds metres long, are commonly observed in loose alluvial deposits and/or saturated soils; in rare cases fractures up to 1 cm can be observed in competent dry rocks. Decimetric cracks are common in paved (asphalt or stone) roads, as well as small pressure undulations.*	Small to moderate (10^3 - 10^5 m^3) landslides are widespread in prone areas; rarely they can occur also on gentle slopes; where equilibrium is unstable (steep slopes of loose / saturated soils; rock falls on steep gorges, coastal cliffs) their size is sometimes large (10^5 - 10^6 m^3). Landslides can occasionally dam narrow valleys causing temporary or even permanent lakes. Ruptures, slides and falls affect riverbanks and artificial embankments and excavations (e.g., road cuts, quarries) in loose sediment or weathered / fractured rock. Frequent is the occurrence of landslides under the sea level in coastal areas.	*Trees shake vigorously; branches may break and fall, trees may be uprooted, especially along steep slopes.*	*Liquefaction may be frequent in the epicentral area, depending on local conditions; the most typical effects are: sand boils up to ca. 1 m in diameter; apparent water fountains in still waters; localised lateral spreading and settlements (subsidence up to ca. 30 cm), with fissuring parallel to waterfront areas (river banks, lakes, canals, seashores).*	*In dry areas, dust clouds may rise from the ground in the epicentral area.*	Stone sand even small boulders and tree trunks may be thrown in the air, leaving typical imprints in soft soil.	The total affected area is in the order of **100 km²**.
IX	**DESTRUCTIVE** **Effects in the environment are a widspread source of considerable hazard and become important for intensity assessment**	Observed commonly. *Ground ruptures (surface faulting) develop, up to a few km long, with offsets generally in the order of several cm. Tectonic subsidence or uplift of the ground surface with maximum values in the order of a few decimeters may occur.*	*Springs can change, generally temporarily, their flow-rate and/or location to a considerable extent. Some modest springs may even run dry. Temporary variations of water level are commonly observed in wells. Variations of chemical-physical properties of water, most commonly temperature, are observed in springs and/or wells. Water turbidity is common in closed basins, rivers, wells and springs. Gas emissions, often sulphureous, are observed, and bushes and grass near emission zones may burn.*	*Meters high waves develop in still and running waters. In flood plains water streams may even change their course, also because of land subsidence. Small basins may appear or be emptied. Depending on shape of sea bottom and coastline, dangerous tsunamis may reach the shores with runups of up to several meters flooding wide areas. Widespread erosion and dumping of waste is observed along the beaches, where bushes and trees can be eradicated and drifted away.*	*Fractures up to 100 cm wide and up to hundreds metres long are commonly observed in loose alluvial deposits and/or saturated soils; in competent rocks they can reach up to 10 cm. Significant cracks are common in paved (asphalt or stone) roads, as well as small pressure undulations.*	*Landsliding is widespread in prone areas, also on gentle slopes; where equilibrium is unstable (steep slopes of loose / saturated soils; rock falls on steep gorges, coastal cliffs) their size is frequently large (10^5 m^3), sometimes very large (10^6 m^3). Landslides can dam narrow valleys causing temporary or even permanent lakes. Riverbanks, artificial embankments and excavations (e.g., road cuts, quarries) frequently collapse. Frequent are large landslides under the sea level in coastal areas.*	*Trees shake vigorously; branches and thin tree trunks frequently break and fall. Some trees might be uprooted and fall, especially along steep slopes.*	*Liquefaction and water upsurge are frequent; sand boils up to 3 m in diameter; the most typical effects are:apparent water fountains in still waters; frequent lateral spreading and settlements (subsidence of more than ca. 30 cm), with fissuring parallel to waterfront areas (river banks, lakes, canals, seashores).*	In dry areas, dust clouds may rise from the ground.	*Small boulders and tree trunks may be thrown in the air and move away from their site for meters, also depending on slope angle and roundness, leaving typical imprints in soft soil.*	*The total affected area is in the order of **1,000 km²**.*
X	**VERY DESTRUCTIVE** **Effects in the environment become a leading source of hazards and are critical for intensity assessment**	Become leading. *Surface faulting can extend for few tens of km, with offsets from tens of cm up to a few meters. Gravity grabens and elongated depressions develop; for very shallow focus earthquakes in volcanic areas rupture lengths might be much lower. Tectonic subsidence or uplift of the ground surface with maximum values in the order of few meters may occur.*	Many springs significantly change their flow-rate and/or elevation of outcrop. Some springs may run temporarily or even permanently dry. Temporary variations of water level are commonly observed in wells. Even strong variations of chemical-physical properties of water, most commonly temperature, are observed in springs and/or wells. Often water becomes very muddy in even large basins, rivers, wells and springs. Gas emissions, often sulphureous, are observed, and bushes and grass near emission zones may burn.	*Meters high waves develop in even big lakes and rivers, which overflow from their beds. In flood plains rivers may change their course, temporary or even permanently, also because of widespread land subsidence. Basins may appear or be emptied. Depending on shape of sea bottom and coastline, tsunamis may reach the shores with runups exceeding 5 m flooding flat areas for thousands of meters inland. Small boulders can be dragged for many meters. Widespread deep erosion is observed along the shores, with noteworthy changes of the coastline profile. Trees nearshore are eradicated and drifted away.*	*Open ground cracks up to more than 1 m wide and up to hundred metres long are frequent, mainly in loose alluvial deposits and/or saturated soils; in competent rocks opening reaches several decimeters. Wide cracks develop in paved (asphalt or stone) roads, as well as pressure undulations.*	*Large landslides and rock-falls (> 10^5 - 10^6 m^3) are frequent, practically regardless of equilibrium state of the slopes, causing temporary or permanent barrier lakes. River banks, artificial embankments, and sides of excavations typically collapse. Levees and earth dams may also incur serious damage. Frequent are large landslides under the sea level in coastal areas.*	*Trees shake vigorously; many branches and tree trunks break and fall. Some trees might be uprooted and fall.*	*Liquefaction, with water upsurge and soil compaction, may change the aspect of wide zones; sand volcanoes may even be more than 6 m in diameter; vertical subsidence even > 1m; large and long fissures due to lateral spreading are common.*	In dry areas, dust clouds commonly rise from the ground.	*Boulders (diameter in excess of 2-3 meters) can be thrown in the air and move away from their site for hundreds of meters down even gentle slopes, leaving typical imprints in soil.*	*The total affected area is in the order of **5,000 km²**.*
XI	**DEVASTATING** **Effects in the environment become decisive for intensity assessment, due to saturation of structural damage**	Are dominant. *Surface faulting extends from several tens of km up to more than one hundred km, accompanied by slips reaching several meters. Gravity graben, elongated depressions and pressure ridges develop. Drainage lines can be seriously offset. Tectonic subsidence or uplift of the ground surface with maximum values in the order of numerous meters may occur.*	Many springs significantly change their flow-rate and/or elevation of outcrop. Many springs may run temporarily or even permanently dry. Temporary or permanent variations of water level are generally observed in wells. Even strong variations of chemical-physical properties of water, most commonly temperature, are observed in springs and/or wells. Often water becomes very muddy in even large basins, rivers, wells and springs. Gas emissions, often sulphureous, are observed, and bushes and grass near emission zones may burn.	*Large waves develop in big lakes and rivers, which overflow from their beds. In flood plains rivers can change their course, temporary or even permanently, also because of widespread land subsidence and landsliding. Basins may appear or be emptied. Depending on shape of sea bottom and coastline, tsunamis may reach the shores with runups reaching 15 meters and more devastating flat areas for kilometers inland. Even meter-sized boulders can be dragged for long distances. Widespread deep erosion is observed along the shores, with noteworthy changes of the coastal morphology. Trees nearshore are eradicated and drifted away. along the shores, with noteworthy changes of the coastline profile. Trees nearshore are eradicated and drifted away.*	Open ground cracks up to several meters wide are very frequent, mainly in loose alluvial deposits and/or saturated soils. In competent rocks they can reach 1 m. Very wide cracks develop in paved (asphalt or stone) roads, as well as large pressure undulations.	Large landslides and rock-falls (> 10^5 - 10^6 m^3) are frequent, practically regardless of equilibrium state of slopes, causing many temporary or permanent barrier lakes. River banks, artificial embankments, and sides of excavations typically collapse. Levees and earth dams incur serious damage. Significant landslides can occur even at 200 – 300 km distance from the epicenter. Frequent are large landslides under the sea level in coastal areas.	*Trees shake vigorously; many branches and tree trunks break and fall. Many trees are uprooted and fall.*	Liquefaction changes the aspect of extensive zones of lowland, determining vertical subsidence possibly exceeding several meters; numerous large sand volcanoes, and severe lateral spreading can be observed.	In dry areas dust clouds arise from the ground.	*Big boulders (diameter of several meters) can be thrown in the air and move away from their site for long distances down even gentle slopes, leaving typical imprints in soil.*	*The total affected area is in the order of **10,000 km²**.*
XII	**COMPLETELY DEVASTATING** **Effects in the environment are the only tool for intensity assessment**	Are dominant. *Surface faulting is at least few hundreds of km long, accompanied by offsets reaching several tens of meters. Gravity graben, elongated depressions and pressure ridges develop. Drainage lines can be seriously offset. Landscape and geomorphological changes induced by primary effects can attain extraordinary extent and size (typical examples are the uplift or subsidence of coastlines by several meters, appearance or disappearance from sight of significant landscape elements, rivers changing course, origination of waterfalls, formation or disappearance of lakes).*	Many springs significantly change their flow-rate and/or elevation of outcrop. Temporary or permanent variations of water level are generally observed in wells. Many springs and wells may run temporarily or even permanently dry. Strong variations of chemical-physical properties of water, most commonly temperature, are observed in springs and/or wells. Water becomes very muddy in even large basins, rivers, wells and springs. Gas emissions, often sulphureous, are observed, and bushes and grass near emission zones may burn.	*Giant waves develop in lakes and rivers, which overflow from their beds. In flood plains rivers change their course and even their flow direction, temporary or even permanently, also because of widespread land subsidence and landsliding. Large basins may appear or be emptied. Depending on shape of sea bottom and coastline, tsunamis may reach the shores with runups of several tens of meters devastating flat areas for many kilometers inland. Big boulders can be dragged for long distances. Widespread deep erosion is observed along the shores, with outstanding changes of the coastal morphology. Many trees are eradicated and drifted away. All boats are lore from their moorings and swept away or carried onshore even for long distances. All people outdoor are swept away.*	Ground open cracks are very frequent, up to one meter or more wide in the bedrock, up to more than 10 m wide in loose alluvial deposits and/or saturated soils. These may extend up to several kilometers in length.	Large landslides and rock-falls (> 10^{5} - 10^{6} m^3) are frequent, practically regardless to equilibrium state of the slopes, causing many temporary or permanent barrier lakes. River banks, artificial embankments, and sides of excavations typically collapse. Levees and earth dams incur serious damage. Significant landslides can occur at more than 200 – 300 km distance from the epicenter. Frequent are very large landslides under the sea level in coastal areas.	Trees shake vigorously; many branches and tree trunks break and fall. Many trees are uprooted and fall.	Liquefaction occurs over large areas and changes the morphology of extensive flat zones, determining vertical subsidence exceeding several meters, widespread large sand volcanoes, and extensive severe lateral spreading can be observed.	In dry areas dust clouds arise from the ground.	*Also very big boulders can be thrown in the air and move for long distances even down very gentle slopes, leaving typical imprints in soil.*	*The total affected area is in the order of **50,000 km²** and more*