

SOME EXEMPLES OF NATURAL HAZARDS AFFECTING GEOSITES AND TOURIST ACTIVITIES

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Abstract: Tourist activity and tourist destinations can be affected by natural disasters: e.g. volcanic eruptions, seismic events, landslides, avalanches for mountain tourist destination, high waves and intense precipitations, hurricanes for costal areas etc which can substantially modify the geomorphologic landscape of a certain region. The physiological and behaviorist studies are required in order to understand the “*fear of risk*” for „*no-escape*” natural disasters destinations and how it influences the choice of a tourism destination. It may be also noticed the possible positive effect of natural hazards on heritage, can unearth old archeological remains which had been undiscovered.

Key words: natural hazards, heritage, tourist destinations, negative and effects and positive effect

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Natural hazards e.g. volcanic eruptions, seismic events, landslides, avalanches in the high mountain regions, high waves and intense precipitations, hurricanes for coastal areas etc. can affect tourist activities and tourist destinations and also can substantially modify the landscape of a certain region. The paper will present some examples of natural hazards affect geosites and tourist activities and tourist destinations in negative and positive way (Ilieș, 2010).

Seismic activity can engender the destruction of material goods, sometimes affecting cultural, historical or archeological sites. For example, the “*Colossus of Rhodes*” (Greece) the impressive statue of the Greek God of the Sun, Helios, classical antiquity period built, towering for more than 56 years over the harbor entrance; apparently, the statue was destroyed as a consequence of an earthquake in 225 B.C.

Concerning the remains of the *ancient city of Callatis* (6th century B.C.) the

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researches conducted recently has found evidence that the ancient stronghold and its harbor stretch over 2 miles at sea¹ are most probably found on the sea bed of the Black Sea, as the city sunk near Mangalia, Romania. The remains of the fortress should correspond (Badea, 2010) to the subsidence process characterized by values of 0.3 – 0.4 m/century, cummulated for the almost 15 centuries, taking into account that “*the faults - especially the main ones and those that structurally delimitate the Southern Dobroudja Tableland - will always be reactivated, defining this tableland as a horst, in relation with the neighbouring units from the north towards the south*” (Badea, 2010, pp. 7) and confirms the hypothesis of the disappearance of the settlement as a consequence of the *neotectonic process and seismic activity*.

In 1953, in the area surrounding Mount Ruapehu (the oldest national park of New Zealand) after the *volcanic eruption*, a *lahar* destroyed a railway bridge and derailed a train at Tangiwai, causing the death of over 150 people. Recently, a ski field was opened near the cone of Ruapehu volcano (in 1987, the tourist capacity of the field was of approx. 20 000 skiers/hour and reached 40000 skiers/hour in 2004). In September 1995 and August 1996, the volcano threw out ash on a radius of 250 km and on the 23rd September 1995, a “*lahar crossed the ski slop*”, only meters away from the ski-lift installation which was “*stopped for a short period of time...right before the event*”². These events had a negative impact by: decreasing the number of tourists, losses registered by airline companies, damages/destruction of the infrastructure etc.

By introducing a great amount of energy into the slope system, earthquakes can *trigger landslides, collapses, tumbling rocks* etc. which can substantially modify the geomorphologic landscape of a certain region. Such was the case in the *Lavini di Marco landslide, in Italy* (fig.1 a, b) described by Dante Alighieri in his *Divine Comedy* as follows: (in translation) “*Over the edge, an enormous rock slide led down through a desolate mountainous terrain that was appalling to see. It resembled the lifeless slope of stone that tumbles down to the left bank of the River Adige, all of the way to Trent, the result of some massive earthquake.*”³



Figure 1a and 1b. Landslides from Lavini di Marco, Italy
(foto: D. Castaldini)

In what concerns coastal areas (Snoussi et al. 2009, Teixeira, 2006) we can offer as an example the tourist resort Villafranche sur Mer, on the French Riviera (France), included on UNESCO's list of Mediterranean architectural heritage. The commune was founded in the XIIIth century by Charles II, Duke of Anjou and is notable due to its unique tourist sites such as the frescoes of Saint Peter's Chapel which were restored by Jean

¹ <http://www.romanalibera.ro/a170497/orasul-antic-de-sub-marea-neagra.html>

² http://en.wikipedia.org/wiki/Mount_Ruapehu

³ *Inferno*, 12, 6

Cocteau (Panizza, 2005, Panizza and Piacente, 2005, Panizza and Piacente, 2008). The *geomorphologic hazards of this coastal area are related to submarine erosion as well as to significant landslides which affect the inhabited areas* and can generate risks. Other hazards are related to *high waves and intense precipitations* which can generate floods. On 25 and 26th August 2002, apart of the resort's citadel was destroyed. The number of tourists visiting this area is large and the preventive measures which were taken have decreased their impact on the environment. A preservation project of naval archeology is also being implemented. The commune's restoration project is designed according to environmental and traditional elements. In the coastal area of Portofino National Park (Italy) Brandolini et al., 2006 analyzed the types of natural processes, the rock substrate, the meteorological conditions etc, which can affect tourists and this tourist destination. Other than these elements which concern the "*infrastructure*", tourist vulnerability (tourist influx, existing infrastructure etc.) and the types of visitors (gender, level of education, physical training, equipment) are also being studied. *Geomorphologic hazards and the tourist vulnerability are common to highly tourist populated bays, the promontories of which are susceptible to slope instability phenomena*. Thus, the fragmentation of *rock masses can lead to collapses and slopes can endanger climbers* as failure layers can appear. These, along with tourist vulnerability (lack of adequate equipment, narrow tourist routes, lack of proper signalization) can lead to numerous accidents. The geomorphologic dynamic of the area is characterized by *physical features and processes influenced by gravitation, water flow in the slopes and by the activity of the sea*. The mentioned authors have drawn up the map of geomorphologic risk for the area of tourist routes in coastal Portofino National Coastal Park (figure 2).

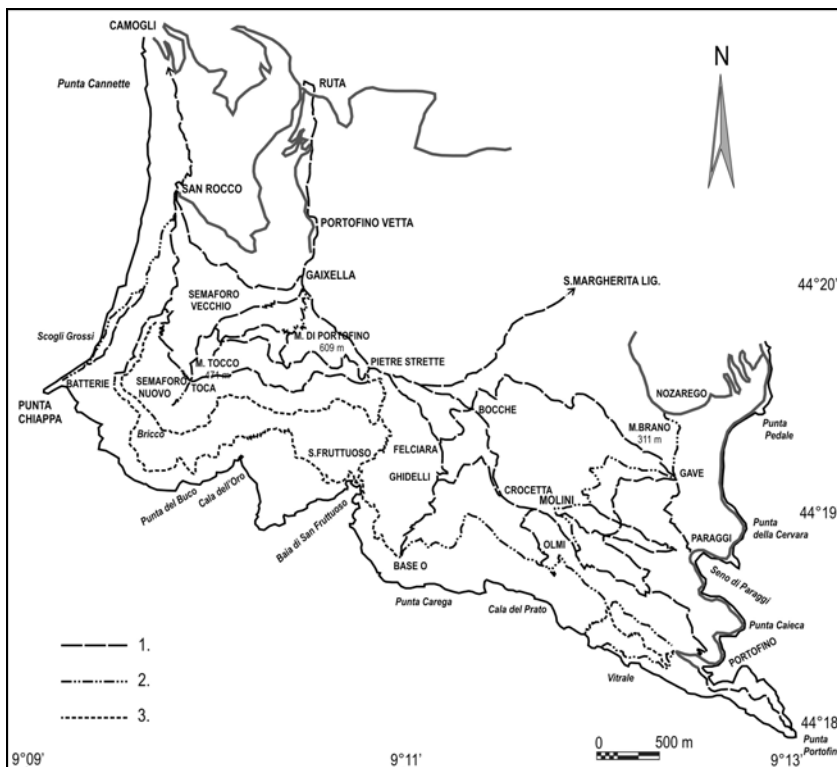


Figure 2. The map of geomorphologic risk for the Portofino (Italy) coastal National Park routes:
 1. Area presenting a minim risk; 2. Area of medium risk; 3. Area presenting a high risk.
 (Source: Brandolini et al., 2006, 569)

In Martinique, hurricanes „Dean” (figure 3) and „Ivan” (figure 4) destroyed the beach and the berm due to the force of the waves they engendered in 2008.

The natural hazards for *high altitude areas* (e.g.: Switzerland) is most useful as it highlights the slopes which present a higher *risk of avalanches, ice accumulation, collapses, floods* caused by glacial lakes overflows, ice melting, ice avalanches, glacier melting, combinations and variations of these as well as chain-events corresponding to these phenomena (Eitzinger and Wiedemann, 2007). Examples: *floods caused by the melting of ice* (a volume of over 3 m³, speeds reaching more than 40.000 mc/s on distances of 1200 km); *torrent activity* etc. Also in high altitude mountain areas, glacier-related hazards and permafrost can damage the tourist infrastructure due to floods etc. (Kaab et al., 2008). All of these represent an important data source which can be used in territorial planning and tourist administration.



Figure 3. The consequences of „Dean” hurricane in Martinique, France
(foto: O. Dehoorne, 2008)



Figure 4. The consequences of „Ivan” hurricane in Martinique, France
(foto: O. Dehoorne, 2008)

Several „no-escape” natural disasters destinations (Huan et al., 2004) can be pointed out. One is the powerful earthquake, 7.6 on the Richter scale intensity, which affected Taiwan (a fashionable tourism destination) in year 1999 (was so called “*the earthquake of the century*”) and grave damaged local tourism. Thus, physiological and behaviorist studies are required in order to understand the “*fear of risk*” and how it influences the choice of a tourism destination perceived as bearing the risk of a “*no-escape*” natural disaster.

For example in high altitude mountain areas, the modifications of the volume of ice determine major changes of the landscape. The geosites created by glaciers (ex: moraines, ice tongues etc.) suffer a rapid degradation due to natural processes and to the impact of some tourist activities. The peri-glacial and pro-glacial areas are characterized by phenomena of instability: landslides, collapses etc. The intensification of the phenomena involving material dislocation can also increase the difficulty of following touristic routes. The morphological changes which may occur demand the preservation of pre-established itineraries. These are to be modified only if they become impassable or if they no longer correspond to a certain type of activity.

The limits of *Marlet Glacier of Val Solda* (Alto Adige, Italy) (Pelfini and Bozzoni, 2008), are a useful example in this paper case, as they are permanently undergoing volumetric transformations of the glacier, which determines modifications of the tourist routes. Geomorphological sites of this type can suffer degradation processes (as is the case of blade-like moraines which can be negatively impacted by tourism). „*Debris flow*” and „*mud flow*” processes which affect moraines have hindered access to the glacier, consequently modifying the tourist classification of the itinerary from tourists` route to

alpine itinerary. Snow avalanches affect tourism (snowboarders, skiers) but also public transportation corridors (e.g.: western Canada) (Stethem et al., 2004). Therefore, there is a need of anticipating avalanches, of studying the relationship between forests and avalanches as well as the impact of climatic changes over the forming of avalanches etc. The mapping of areas which are susceptible to avalanches also proves useful, providing the risk map of the massif.

Mara and Vlad, 2008, 184, noticed also the *positive effect* of natural hazards on patrimony, as these can unearth old archeological remains which had been undiscovered as they had been buried under thick deposits of sediments, as is the case of *Scythia Minor* (Dobrogea, Romania). *Exogenous factors, erosion, corrosion and hydro-meteorological* natural hazards (floods and droughts) can contribute to the unearthing of important historical and archeological vestiges. Thus, in 2003, the low water level of the Danube allowed archeologists to conduct investigations in the southern area of a Byzantine fortress which was normally submerged. While 1973 research had discovered in this location wood remains which probably belonged to a ship repair dock, the 2003 drought revealed the in river bed, in situ, the wooden foundation of a structure belonging to the city's fortification walls (figure 4) which was covered by a slate of limestone shaped as bricks, manually handcrafted and originating from a nearby quarry. The technique used for its manufacturing is extraordinary, the above mentioned authors finding it unique for Byzantine constructions on instable and flooded terrain.

CONCLUSIONS

The paper surprise some examples of natural disasters can affect the heritage, tourist activity and tourist destinations. Seismic activity can engender the destruction of material goods, sometimes affecting cultural, historical or archeological sites. Alpine tourist destinations which specialize in skiing can be affected by storms, avalanches etc. The geomorphologic hazards of this coastal area are related to submarine erosion as well as to significant landslides which affect the inhabited areas and can generate risks. These events had a negative impact by: decreasing the number of tourists, losses registered by airline companies, damages/destruction of the infrastructure etc. But it is also noticed the possible positive effect of natural hazards on heritage, which can unearth old archeological remains which had been undiscovered. All of these represent an important data source which can be used in territorial planning and tourist administration

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