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POSITIVE EFFECTS OF NATURAL HAZARDS ON CULTURAL HERITAGE IN ROMANIA

ABSTRACT: MARA S. & VLAD S.N., *Positive effects of natural hazards on cultural heritage in Romania*. (IT ISSN 0391-9838, 2008).

Due to the increased trend of global warming and accompanying natural disasters, which may vary from extreme drought to severe floods in various parts of Europe, specific measures are to be taken from trans-national to local levels. Among them, it is worth mentioning to support local authorities in promoting/implementing the concept of sustainable development, in terms of land use and protection of the national heritage and disaster management.

Consequently, public information about possible consequences due to natural hazards is highly recommended in economically developed regions with enclosed tourist resorts and specific vulnerable environment. Such an activity can lead to a more precautionary behaviour of the local population and tourists, and, furthermore, to limitation of the damages in case of a natural disaster. A measure of this kind consists of warning panels, posters and leaflets, available in the areas of high vulnerability for natural disasters, advising people living in the very area and tourists to pay attention or even to avoid the dangerous areas, because natural hazards can happen frequently affecting both environment and infrastructures.

In other words, an efficient informational system concerning risks produced by natural disasters is of main importance for local authorities, environmental protection agencies and water management systems. The improvement of the disaster management in the European Union and candidate countries should be based on implementation of lessons learned from previous disasters.

The paper presents a dichotomic paradox, i.e. positive versus negative effects of the natural hazards taking into account examples from Romania.

Our case studies concentrate on such positive impact that reveals very important archaeological treasures, buried for hundreds years beneath a thick sedimentary cover or at the bottom of shallow waters.

Both sites are located in Dobrogea, the antique Scythia Minor.

KEY WORDS: Natural hazards, Cultural heritage, Vulnerability, Romania.

INTRODUCTION

During the last decades, there have been natural processes that are hazardous to people in Romania and the European Union. The Romanian territory underwent severe floods (1970-71, 1977, 2005 and 2006) and earthquakes (1977, 1986 and 1990) that killed thousands of people and produced significant financial, social and infrastructure losses.

It is common sense that such natural hazards are just natural processes controlled by exogenous and/or endogenous factors. They turn into real risk when they take place in regions where humans live or work or pay visits as tourists. Such processes must be recognized, and avoided, and their impact to human life and property minimized.

Under present circumstances, there is a bare necessity for Europe to promote and implement, both institutionally and operationally, the concept of sustainable development, in terms of land use and protection of the national heritage and disaster management.

Due to the increased trend of global warming and accompanying hydro-meteorological hazards which may cause disasters that vary from extreme drought to severe floods in various parts of Europe and particularly in Romania, specific measures are to be taken from trans-national to local levels. Public information in economically developed regions with enclosed tourist resorts, regarding the possible consequences due to natural hazards specific of the region is highly recommended. Such an activity can lead to a more precautionary behaviour of the local population and tourists, and, furthermore, to limitation of the damages in case of a natural disaster. A measure of this kind consists of warning panels, posters and leaflets, available in the areas of high vulnerability for natural disasters, advising people living in the very area and tourists to pay attention or even to avoid the dangerous areas, because natural hazards can happen frequently affecting both environment and infrastructures.

Needless to say that an efficient information system concerning risks produced by natural disasters is of main importance for local authorities, environmental protection agencies and water management systems. According to the accepted definition, Risk is equal to Hazard multiplied by

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Vulnerability (Risk = Hazard x Vulnerability). Whilst the occurrence probability of the disaster is generally known, especially regarding the dangerous meteorological phenomena, the evaluation of the consequences, or the vulnerability, is difficult to estimate and involves a lot of unknown factors. It is significant to assess the complex context in which risk occurs and the people do not express similar perceptions of risk and associated causes. The improvement of the disaster management in the European Union and candidate countries should be based on implementation of lessons learned learned from previous disasters.

As a particular account of hazard analysis starting from potential harm to tourist livelihood in vulnerable environment, the graded insurance premium concept is suggested. Graded insurance premiums should be promoted to tourists traveling in remote areas, based on a preliminary risk evaluation of the tourist areas. These graded insurance premiums should be introduced by the tourist agencies as a new mechanism for improving the safety of the tourists, which will be informed in due time about the possible hazards in the area of the forecasted travel tours. Therefore the vulnerable areas will be automatically avoided by the land owners or entrepreneurs for resorts development, because of the increased insurance premiums. Complementary, lower risk areas will be targeted by the tourist agencies.

Besides the well known negative effects of the natural disasters over the economic, social and cultural aspects of the humankind which affect nowadays the inhabited areas too, positive effect resulting from natural hazards can be identified, especially within tourist areas, in order to preserve the remarkable archaeological treasures, which certifies the cultural heritage of the national long-lived history. Case studies of this kind are presented below.

CASE STUDIES ON ARCHAEOLOGICAL SITES IN DOBROGEA

We selected two sites one buried for hundreds years beneath a thick sedimentary cover, the other submerged at the bottom of shallow waters. Almost impossible to be localised by normal excavation techniques they consists of a) an unique originally preserved Byzantine defence wall, wooden made, intricate by stones and clay, emerged from the Danube during a severe drought in 2003, and b) a Roman-Greek palaeo-Christian basilica uncovered from a thick loess cap by a flaush flood due to heavy rain in 1971 (Baumann, 1976; Baumann, 1977; Botzan, 1984). Both sites are located in Dobrogea (fig. 1), the antique Scythia Minor. Located in the south-eastern Romania, between the

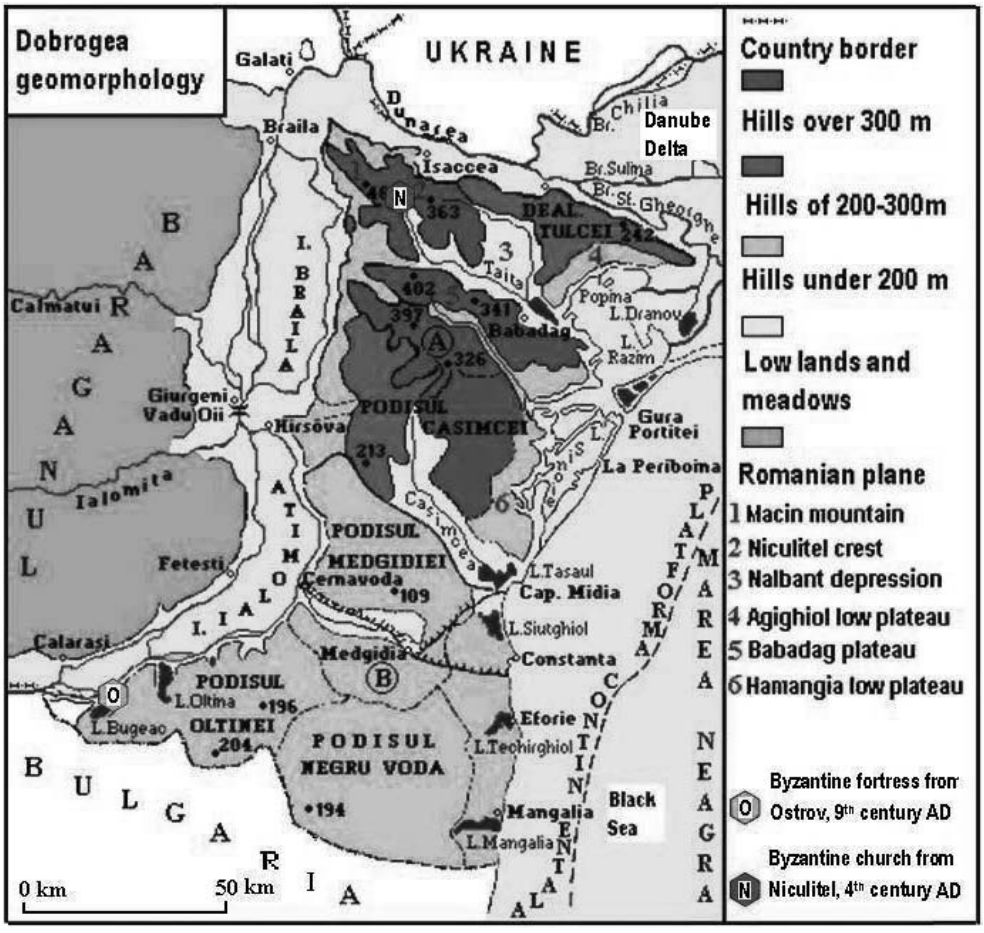

FIG. 1 - Location of case study sites from Dobrogea, Romania.

Danube and the Black Sea, this is a region of famous Greek-Roman inheritance and Precambrian to Quaternary geology resulting in a very spectacular combination of natural and anthropogenic environment.

Environmental characteristics of Dobrogea

Dobrogea belongs to the Carpathian foreland and consists of three units: North Dobrogea, subdivided into the Hercynian orogenic structure in the west and Tulcea Zone in the east, a Triassic aulacogene extending to Crimea and Lesser Caucasus; Central Dobrogea and Southern Dobrogea of Pre-alpine Platform type (Vlad, 2005). Dobrogea is an area with scarcity of surface water resources, despite the fact it is bordered in the West and in the North by the Danube and to the East by the Black Sea. The restricted river network includes a few rivers and lakes nearby the shoreline. Dobrogea is the poorest in running surface water resources all over the country, and almost without consistent running surface waters. The hydrographic network main characteristic is the scarcity of the runoff. The valleys are very large, some of them having just temporarily water. The erosion material is transported just on short distances at the base of the slopes, and is just partially transported along some valleys with surface waters. The large valleys are covered with a thick loess deposits and deluvial-proluvial sediments, which are covering the older deposits. Commonly single torrential rains produce the runoff. The main floods had been produced on some temporary valleys, during 1971, 1972, 1975, 1977 and respectively 1985. The maximum discharge flows recorded range from 80 m^3/s to 450 m^3/s. The transit time of the discharge flows is smaller, up to 1 or 2 days. Soil erosion is increased especially by the torrential floods which generate a higher kinetic energy, but also by other features, such as: the reduced degree of cover vegetation, the increased degree of slope and the soil composition. Land degradations and water courses clogging with debris, especially in the flooding periods occur as a result of land erosion (Posea & *alii*, 1974).

Byzantine defence wall emerged in 2003 in the Danube, nearby Ostrov locality

Effects of extreme drought

From the climatic point of view, 2003 was an exception. Most of Europe was affected by drought, with high temperatures and deficit precipitation regime. The historical maximum temperatures were exceeded in England (38.1 °C), in France and Germany (40.4 °C). Other negative aspects effects occurred in the Iberian Peninsula and Italy, where the drought affected the tourism, in The Netherlands where restrictive measures for reducing the electrical consumption were taken by the authorities, in the Balkans and Eastern Europe (Moldova Republic, Ukraine) where the agricultural crops were partially compromised.

In Romania, after a relatively mild winter, but prolonged until April, starting with May the thermal regime became excessively dry. May and June, which, statistically the rainiest months of the year, were practically without precipitation. The drought regime took place rapidly and severely. The drought affected mostly the southern part of Romania, as a result of lack of precipitation, high temperatures, groundwater table lowering and correspondent increasing of rivers drought. By combining the effects, the meteorological and hydrological droughts generated soil drought, resulting in local severe drought (fig. 2). The in-

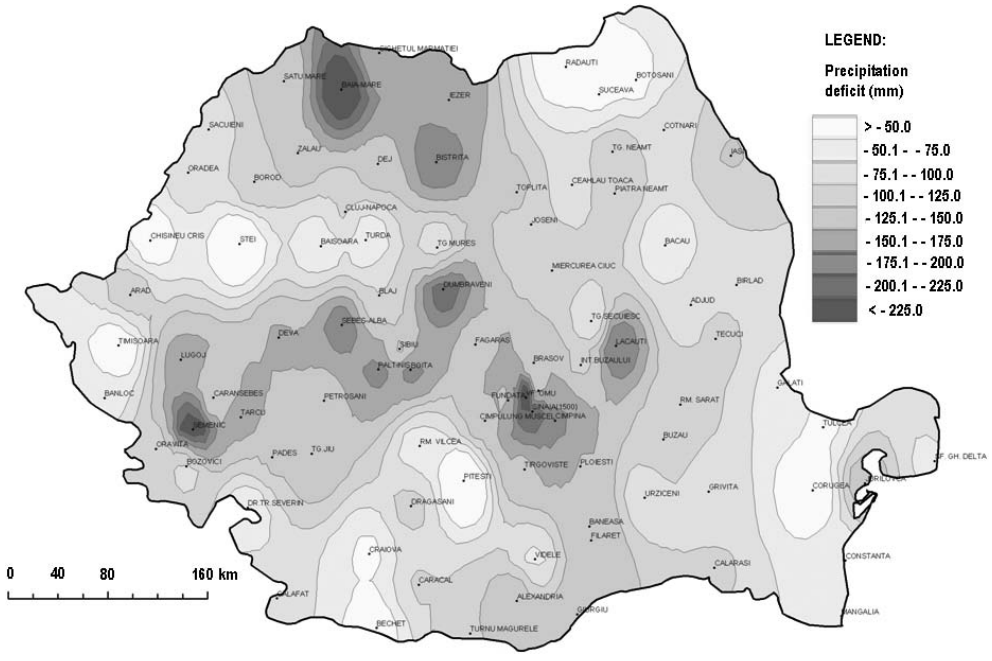

FIG. 2 - Precipitation deficit in Romania during January - July 2003 (data source ANM-National Meteorological Agency).

creased air temperatures, over critical limits of biological strength, associated with the long lasting atmospheric and soil drought, worsened the vegetation status of the agricultural crops.

Danube River reached the minimum flow rate recorded in the lower part of the stream with almost 1600 cm/s compared with the mean value of the monthly multi-annual of 5.500 cm/s. Just by the year end the precipitation regime increased in Europe, reducing the effects of the drought.

A unique originally preserved Byzantine docking structure, wooden made, intricate by stones and clay, emerged during the extreme drought of 2003 close to Ostrov, by the Romanian bank of the Danube River, in the southern part of the country. It is represented by the ruins of the ancient strongholds on the Danubian island Păcuiul lui Soare (fig. 3), known as Vicina, which is a natural fortress built in 971, and is presently covered by 90% of his vestiges by the waters of the Danube River.

FIG. 5 - A unique well preserved structure of the fortress basement made by intricate oak trunks grid on the Danube muddy riverbed.

Archaeological founding

The extreme low levels of the Danube waters during summertime of 2003, allowed archaeologists to conduct investigations in the southern extremity of the Byzantine fortress, which is normally submerged by water (figs. 4).

Studies in the area have been conducted since 1973 at a probable docking zone for ship repairing, because of the presence of some wooden remains (fig. 5). During 2003 important vestiges were revealed in the Danube river bed. A real surprise was the discovery in situ of a wooden basement structure of the fortress walls (fig. 5), exhibiting a unique building technique for unstable and flooded terrain, so far unknown throughout any other Byzantine vestige.

The foundation terrain of the island was a real challenge for the ancient builders, because the basement of the fortress consists of unconsolidated clay and sand and the river level and groundwater table show large variations. Until the recent discoveries of 2003, nobody could understand how the muddy soil of the island supported over the centuries the heavy weight of massive masonry of the defence walls of the Byzantine fortress (fig. 6).

The building technique of the Byzantines consisted of a network of oak trunks, disposed on a grid with intervals of 0.4 m from each other.

The whole wooden structure, placed directly on the muddy soil, was first covered by a unitary masonry plaque,

FIG. 3 - Part of the defense wall of the Byzantine Fortress - Ostrov, on the «Pãcuiul lui Soare» island, known as Vicina, was initially a military naval base and inhabited until mid-15th century.

FIG. 4 - The southern part of the Byzantine fortress is normally covered by the Danube water (left), and the same wall revealed by the 2003 severe drought (right).

FIG. 6 - Detail of the massive masonry walls, with large hand carved limestone bricks.

which became the base for the rest of the massive walls of the fortress, made mainly by carved and hand fashioned limestone blocks, originated from a nearby quarry, on the left bank of the Danube.

Roman-Greek Palaeo-Christian basilica uncovered by a flash flood in 1971 at Niculitel

The aulacogen of the Tulcea zone is characterized by bimodal magmatism of basaltic-rhyiolitic type (Vlad, 2005). Niculitel is a village surrounded by forested hills built up of basaltic lavas with elevation up to 400 m that reach the outskirts of the locality. This relief contrasts significantly with the down-land which is covered as the majority of the Carpathian foreland by a thick loess cover.

Macin Mountains are bordering the area nearby Niculitel village, and it represents the highest area of the Dobrogea Plateau. These mountains are eroded, being a remained of the Hercinic orogen, with a maximum altitude of 467 m. The concerned area is localised into a moderate continental climate, characterised by average annual temperatures of 10.8 °C and 9 °C, respectively precipitations between 480.4 mm and 600 mm, being the most arid mountain area from Romania (Diaconu, 1971).

Losses due to evaporation and transpiration are closed to the annual precipitation. An increased erosion is present during high waters, when are commonly presented mud torrents. The solid material transported by the rivers is originating mainly from the loess layers. The rainfalls usually have an increased intensity, which are producing frequent high-waters (tab. 1) (Ujvari, 1972).

The flat loess cover is crossed by the local creek that overflow during heavy rains in addition to aggressive runoff from the adjacent hills and revealed the Palaeo-Christian basilica straight in the middle of the village. First the crypt was brought to surface. During successive digging/reconstruction events, the site was subjected to several detailed analyses (1971, 1975, 1985, 1994).

TABLE 1 - Specific torrential rains in Dobrogea

Pluviometer station	Data	Height (mm)	Timing (min)
Jurilovca	3 July 1954	130.2	70
Tulcea	10 August 1939	70.2	30
Constanta	11 August 1939	104.7	125
Mangalia	17 September 1943	94.4	30

Actually, the basilica remains are surrounded by a protective construction, which is integrated in the landscape and architectural style of the area. The access gallery into the tomb offers the visitors a close visual contact with the monument.

The basilica was erected by the end of the 4th century AD, during the rules of emperors Valens and Valentinian the 2nd, according to a Christian Roman layout, with rectangular room shape, divided into three parts by independent pillars which supported the vertical space of the building probably with a wooden two-sided roof, covered with burnt-earthen shingle.

The archaeological works proved that the crypt includes also an older *martyrium*. The martyrs suffered martyrdom under Diocletian (304-305), and were killed in the city. In addition the remains of two previous martyrs, as a result of the repressions by Emperor Decius (249-251), were discovered in the crypt. The names of these martyrs had been placed since their death in church records, from Constantinople, and the find of the tomb with the names written inside was a real surprise, proving the authenticity of the old manuscripts. It seems likely that Dobrogea represented during that remote period, a kind of «Gulag» to early Christians from the whole Roman Empire.

At the beginning of the 5th century, during the rule of emperor Theodosius the 2nd, the basilica was severely changed in shape, horizontally and vertically. It was divided by continuous *stylobates* (pavement supporting high columns).

The *presbyterium* (a sanctuary were remains of the martyrs were place when the mass was officiated) was surrounded by a transversal wall. Vertically, was built a «cathedral» type roof. In the central zone of the apses, beneath the basement of the altar, a monumental martyr crypt was buried. It was revealed after so many centuries in 1971 by the unexpected flash flood. The four martyrs were found in a common burial chamber in anatomical connection, indicating a primary burial. The name and the age of the other two martyrs found are not yet known. The inscription from the stone which blocks the entrance to the martyricon reveals their identity as Christian martyrs, indicating that «Here and there (is) the blood of the martyrs».

CONCLUSIONS

Commonly, the effects of the natural hazards over the cultural heritage is considered as negative, but sometimes

the impact effect of the hazards may disclose unknown archaeological vestiges, including masterpieces of technical genius or marvellous art. These precious cultural vestiges, isolated by the exogenous erosion and corrosion factors, can be unveiled by acting natural hazards, especially of hydro-meteorological type, such as floods and drought.

Generally, the impact of anthropogenic activities combined with the global warming and other natural versus human-induced hazards affect nowadays the national heritage, sometimes with disastrous consequences for the tourist areas where outflow of people toward archaeological vestiges or natural monuments is expected to increase.

In order to understand the complexity of the mechanism of natural hazards, we should acknowledge their dichotomy that is negative effects of loss of life, injury, property damage, economic disorganizations, and environmental disturbance versus the paradox role on discovering precious archaeological treasures and broadening the cultural heritage.

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