Valuing abiotic nature - upgrading preliminary version of Geosite Assessment Model (GAM) by using Analytic Hierarchy Process (AHP)

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Besides living nature, flora and fauna, recent European leisure trends have shown heightened appreciation of non-living natural resources – geodiversity, which can be presented to the tourists in the form of geosites. The evaluation of geosites has been developing since the 1990s in terms of their interpretative potential and provision (Hose 2000). Preliminary Geosite Assessment Model (GAM) was developed from several existing evaluations, which lead to the numerical assessment criteria proposition from extant literature in the field (Vujičić et al. 2011). According to modification of existing models (e.g. Reynard et al. 2007, Pereira et al. 2007, Zouros, 2007, Pralong 2005) that specify two groups of indicators – scientific and additional, GAM proposed main and additional values.

The first group, main values, comprises three indicators: scientific/educational, scenic/aesthetical and protection values. The first indicator in main values group is scientific and educational value (VSE) with additional component "level of interpretation" as key element for understanding and explanation of geodiversity to wider audience and non-specialists. In contrast to before mentioned references, scenic and aesthetic values (VSA) are by GAM identified as main values, as they are relatively constant in time and not significantly human-influenced in general. This indicator was mostly created after Pralong (2005) with an addition of "environmental fitting of the site", e.g. if a certain manmade outcrop fits to its natural surroundings. Protection (VPr) is presented as indicator of main values, it should be essential activity before any promotional or tourism development in general.

The second indicator group of the geosite assessment model, additional values, is further divided into two indicators, functional and touristic values. Some authors previously proposed some functional elements such as (e.g. Accessibility, Pralong 2005, Pereira et al. 2007 Zouros 2007), but for the purpose of this paper and model Functional value (VFn), was further developed and it consists of six elements. New elements that were added are additional natural values, additional anthropogenic values, vicinity of emissive centres, vicinity of important road network and additional functional values. The purpose of these elements is not tourism development and they do not directly contribute to tourism, but are essential.

The second indicators in the group of additional values, are Tourism values (VTr) and they evaluate the current state of (geo) tourism services and facilities. Several authors proposed some elements of the tourism values - e.g. equipment and support services as a part of Use value (Pereira et al. 2007), management measures (Reynard 2007), economic potential as a potential for use indicator (Zouros 2007), annual number of visitors and attraction as part of economic values (Pralong 2005). In contrast to the previous models, GAM offers tourism values as independent indicator with nine sub-indicators (Promotion, Organized visits, Vicinity of visitors' centre, Interpretative panels, Number of visitors, Tourism infrastructure, Tour guide service, Hostelry service, Restaurant service).

In total, there are 12 sub-indicators of Main Values, and 15 sub-indicators of Additional Values.

GAM = Main Values (VSE+VSA+VPr) + Additional Values (VFn+VTr)

As all sub-indicators are not equally important to the professionals (researchers, academicians etc.) and tourists, authors upgraded GAM by using Analytic Hierarchy Process (AHP), which is one of the most popular tools in decision-making processes and developed new grading scale for sub-indicators. The AHP approach is used to construct an evaluation model and it has criterion weights. It integrates different measures into a single overall score for ranking decision alternatives. Applying it usually results in simplifying a multiple criterion problem by decomposing it into a multilevel hierarchical structure. This model is structured as a set of pair-wise comparisons of decision elements made by the decision maker. At the top of the hierarchy is the goal, the next level contains the criteria, while alternatives lie at the bottom of the hierarchy. Figure 1. shows hierarchy from most important to least important sub-indicator: 1) Rarity, 2) Knowledge on geoscientific issues, 3) Representativeness, 4) Level of interpretation, 5) Environmental fitting of sites, 6) Surrounding landscape and nature, 7) Accessibility, 8) Current condition, 9) Additional natural values, 10) Promotion, 11) Vicinity of visitors centre, 12) Interpretative panels, 13) Viewpoints, 14) Additional antropogenic values, 15) Vicinity of important road network, 16) Vulnerability, 17) Organized visits, 18) Tourism infrastructure, 19) Protection level, 20) Vicinity of emissive centres, 21) Surface, 22) Additional functional values, 23) Tour guide service, 24) Number of visitors, 25) Suitable number of visitors, 26) Hostelry service, 27) Restaurant service. Based on the preliminary results of the assessment, which were performed using Expert Choice 2000 program, new matrix can be formed. First results indicate that the most relevant criteria are Rarity (criterion weight 0.186), Knowledge on geoscientific issues (0.139), Representativeness (0.135), while the least important are Suitable number of visitors (0.004), Hostelry service (0.004) and Restaurant service (0.004). Consistency ratio (CR) is 0.03, which indicates that the study is reliable and accurate enough and there is no need for further adjustments in the comparison (Figure 1).

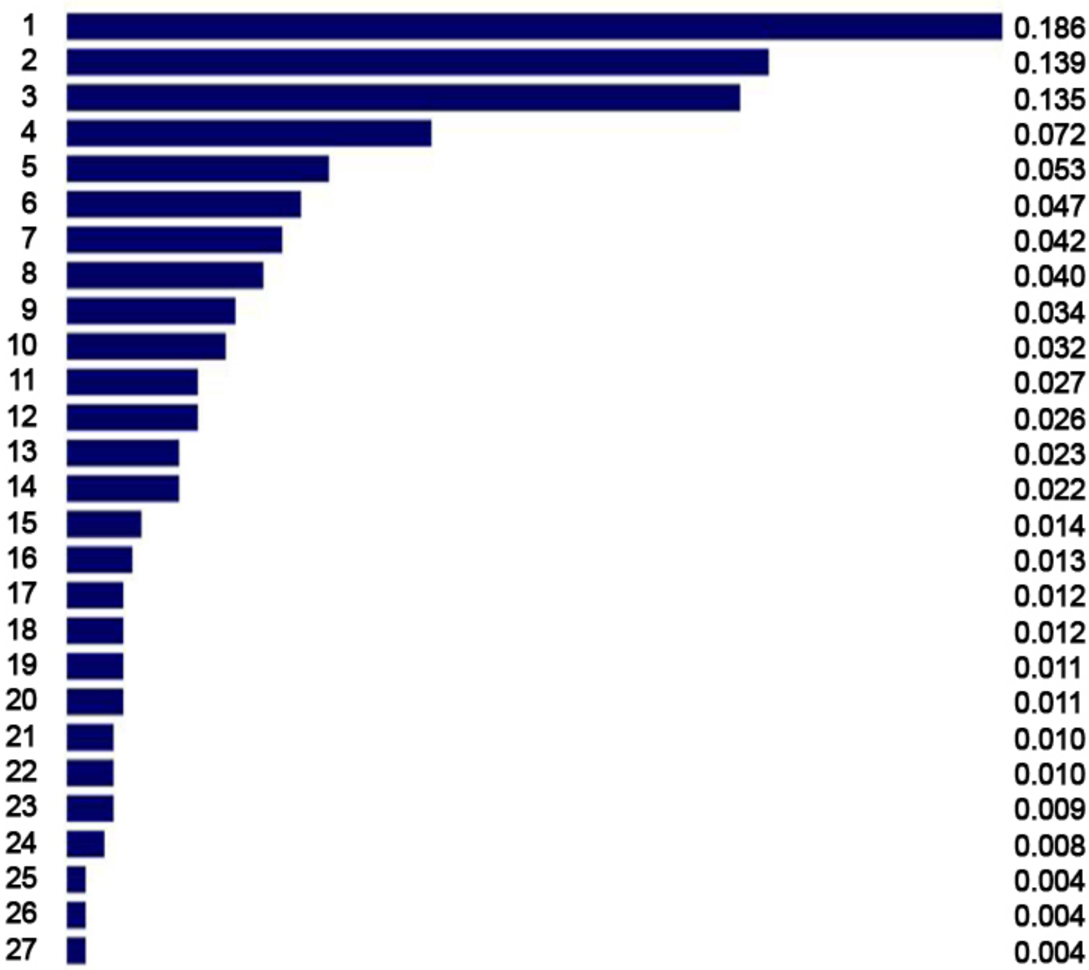

Figure 1. Re-evaluation of sub-indicators by using AHP (Expert Choice 2000 program)

Based on the results of the assessment, a matrix of main and additional values can be created, where these values are presented via X and Y axes respectively. The matrix is divided into nine fields (zones) that are indicated by Z (i,j) (i,j=1,2,3) based on the grade they received in the previous evaluation process. Geosites that fit in cell Z_{31} and Z_{32} have high scientific, aesthetic and protection values, but low developed tourist and functional sector. With that scenario the best way would be that managers promote, plan and enhance mentioned assets, while not degrading the first one. The next scenario is that geosites fit in Z_{11} and Z_{12} cell and have low main values and also low additional values. In this case there can be two possible solutions: the first one is that the geosite has no main values, and because of that additional values are also low; the second scenario is where the geosite is not fully researched and because of that is not protected, which implies that there is no need for additional values. Geosites that fit in Z_{33} and Z_{23} have high ratings in main and additional values. These sites are already developed tourism sites and managers should measure the impact of tourism and threats with constant monitoring of proposed sub-indicators.

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