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Inventorying regionally relevant geomorphosites with best tourism potential in Mpumalanga Province, South Africa

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Abstract

Inventorying or evaluation of geomorphosites, sometimes demands the elaboration of tools which are not supported by an articulated method of inventory and assessment, in other instances, some cards developed together with such methods do not take up the criteria used in the assessment. Besides, not all methods used contain such tools. Thus, we identified the need for a new method of assessment that materializes in the development of a synthetic sheet tool that captures the criteria and rates noted in the evaluative process. The originality of the method emerges from the separation of the structural and functional values of geomorphosites, for which new or improved criteria and ranking are used. Restrictive attributes are evaluated to obtain a complete view upon the possibilities of conservation and exploitation of the geomorphosite. All scores obtained by a geomorphosite are reflected in the inventory tool. This tool also includes general information about the landform, a brief description of the type of geomorphosite and justification for rates given in the evaluative process. A total of 15 potential sites were selected for further assessment, these formed the basis of the inventory of geomorphosites along the Panorama Route. God's Window (GS7), Bourke's Luck Potholes (GS10) Blyde River Canyon (GS11) and Three Rondavels (GS12) are the most valuable geomorphosites along the Panorama Route. Their scores are the highest in total value and final ranking. These are 'panoramic viewpoints' followed by Pinnacle (GS6) which is a 'panoramic viewpoint' with Eco Caves (GS13) and Sudwala Caves (GS15) being the tow caves of significance.

Keywords: geomorphosites, inventory tool, assessment method, Mpumalanga, Panorama Route.

Introduction

The establishment of inventories of geomorphosites in different regions of the world has seen an emphasis being placed on the assessment, selection, and evaluation methods as well as on cartographic representations. Some of these methods include an evaluation or inventory tool or sheet, and others simply adopt a quantitative evaluation of the sites. However, not all of the tools used together with the assessment methods reflect the criteria or even the conclusions of the evaluation, which process simply is a basic approach to starting a new assessment approach. There are, however, some other tools purely descriptive, not based on a valuation method, while other tools are in themselves a method, containing a great number of criteria that allow the detailed evaluation of geomorphosites (Brilha, 2015; Chingombe 2019).

Cocean (2011) indicates that among the five methods developed by the members of the Geosites working group from the IAG, reflect the presence of all of the above situations. The method elaborated and explained by Coratza and Giusti (2005), focuses on the assessment of geosites and aims at their selection, the quantitative assessment of the scientific quality of geomorphological sites and their representations using GIS, rather than the generation of such a tool. Similarly, Bruschi si Cendrero (2005)'s method focuses on the selection of geomorphosites and the identification of criteria for the analysis of intrinsic qualities, use, potential threats and necessary protection of such landforms. This method has remained the most complex and widely applicable method, with good indicators and ranks for each criterion, but it is however not supported by a type of tool for the inventory of geomorphosites.

The method used by Pereira et all. (2007) for the geomorphological heritage, the assessment focuses on the identification of potential geosites, their assessment, selection, and description, but the authors do not bring in an inventory tool that might contain the geomorphological value (scientific and additional) and the management value (use and protection) that are being assessed.

There are however two methods that use such a tool: the method elaborated by Serrano and Trueba Gonzalez (2005) and the one developed by Reynard (2006). The first method contains a Geomorphosite descriptive tool that has four sections. The first two contain data used for the identification of the site (name, number) and its location (administrative unit, coordinates, and altitude). The third part is more descriptive and it refers both to the geomorphological aspects: type of landform, description, morphostructure, erosion, dynamic, chronology and to the geosites' attributes, main and secondary interests.

The last section analyses the uses of the geomorphosite: cultural content, accessibility, level of interest, state of conservation, current uses, communications, infrastructures, impacts, and legal status. This description tool does not use the criteria organization of the method that consists of three parts dedicated to scientific value, additional value and value for use and management. Still, the evaluation tool covers most of the aspects analyzed throughout the assessment. However, the criteria used do not cover all the aspects and the relevance for the geomorphosite assessment, whilst the tool remains descriptive, with no support for quantitative evaluation.

The method developed by Reynard (2009) is in itself an evaluation tool, more complex than the previous one, consisting of six parts. The first one contains general data. The second part focuses on the description of geomorphological features, genesis, and active processes, and also of archaeological elements, modern infrastructures, biotopes, etc. Two more parts contain the actual assessment process, the third analyzing the scientific value using four criteria, often found in bibliography: rareness, integrity, exemplarity, and paleogeographic value, whilst the fourth one assesses the additional values. These values are subsequently used in the calculation of the global value and educational value, together with risk and management measures. The final part contains a list of references. The method is widely applicable, but it sometimes appears to be too simple and descriptive, especially concerning the scientific value of the site.

In general, the above-mentioned methods sometimes use criteria that might be considered too subjective or might be too vaguely expressed. They also have limitations due to the omission of some criteria that are considered relevant from the numerical quantification, as well as from the descriptive tool.

Methodology

This study has therefore developed a new method with its inventory tool that has been applied for the inventory and assessment of the geomorphosites from the Panorama Route of Mpumalanga Province, South Africa. In designing this new method, several aspects were taken into consideration which included the type of elements likely to be considered as geomorphosites which are landforms with special geomorphological features. These landforms have secondary values, represented by certain geological aspects, or the presence of certain hydrological elements, vegetation or fauna, but these aspects are not defined and were marked as such. The geomorphosite quality is dependent on how such landforms are perceived by humans, and the function they are assigned. In the absence of such a function, of any scientific, cultural or economic interest, the landform was not considered as a geomorphosite.

However, if the landform is interesting in itself, it was regarded as a potential geomorphosite. Thus, geomorphosites are landforms that have at least one functional value added to the primary geomorphological one and that are found suitable for the conservation and/or sustainable exploitation. As noted from the above, this assessment method is based on the detachment of structured values, such as geomorphological, aesthetic and ecological, from the functional ones, attributes given after human perception or exploitation, derived from the first ones (cultural, scientific, educational and economic).

The geomorphologic value was assessed using the following criteria (Figure 1): genesis, dynamics, complexity, size, conservation status, rarity and type of structure. The aesthetic value was only an estimated rating: physiognomy, colour, display, elevation or configuration. The ecological value was represented by flora and fauna, as well as the current state and a form of protection.

The cultural value sums up the historical quality, archaeological importance, religious significance, the type of association of the site with different symbols, the artistic value, the frequency of associated cultural events and the architectural features. The scientific value is quantified using the following criteria: scientific significance, scientific resource, formative significance, usefulness as a model, representativeness, paleontological value. In quantifying the scientific value, the separation of the criteria strictly related to this value from the ones evaluating the geomorphologic value, avoiding, therefore, duplication, is very important. For the protection requirements scores ranging from high to low were used which include the assessment of the level of deterioration and vulnerability.

Another criterion used to assess the potential educational use is adapted from de Lima et al. (2010). For the estimation of the economic value, some indicators of tourism potential and exploitation are taken into account: the number of possible recreational activities, the site's tourism potential on various levels, accessibility, type of accommodation infrastructure and the distance from the geosite, present arrangement and services, distance from modern centres with complex services, socio-economic features of the region, status of current tourism exploitation, level of site promotion and frequency of sport competitions.

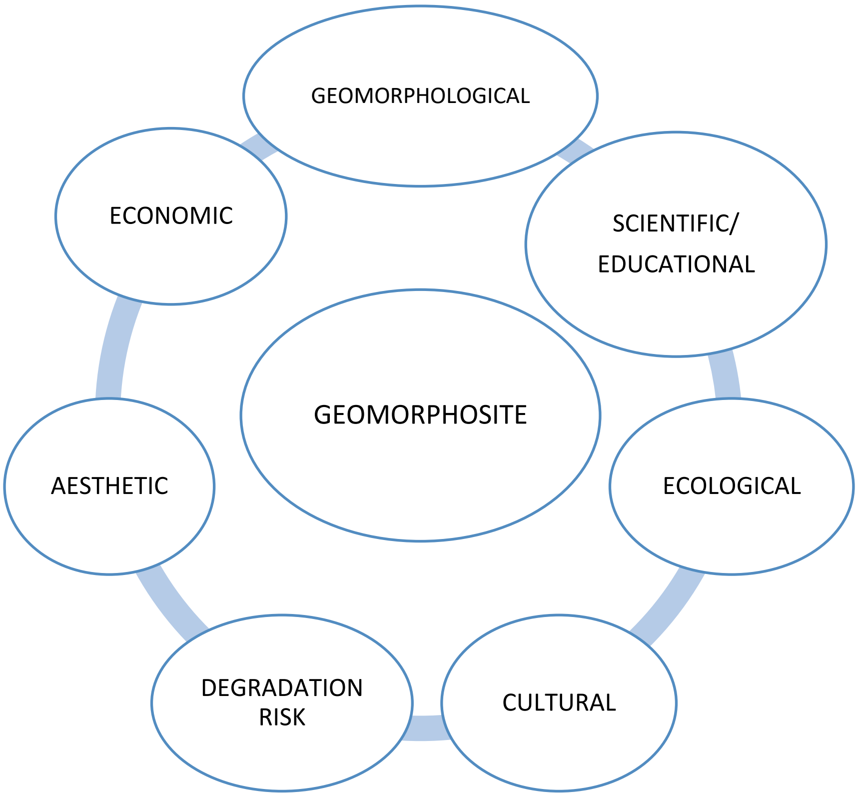

Figure 1. Values of Geomorphosites

Besides the new approach and the original organization of criteria, new features were introduced for a better assessment of both intrinsic or derived values, others that may have been mentioned in different methods, were reconsidered and strictly rated, assessing scores according to their true significance, whilst some have been avoided, such as form of land ownership, which we consider irrelevant, as a private or nationalized form does not have an impact upon the structure and the function of the geomorphosite. For each of the used criteria, there have been established five categories of indices designed to weigh the attributes of each feature on a numerical scale from 0 to 1. There are, however, some characteristics which reduce the value of the site: natural and anthropogenic hazards, vulnerability, the presence of factors that could decrease the attractiveness of the site, as well as the presence of unsightly elements. The numerical values for structural, functional, and restrictive attributes are all sums of the scores of the criteria. Using the total value of the geomorphosite based on the sum of functional and structural values, the value of restrictive attributes is deducted.

The inventory tool for geomorphosites

The inventory tool reflects with exemplary fidelity the criteria used in the assessment method in estimating the different values (geomorphological, aesthetic, ecological, cultural, scientific, educational and economic) that have been evaluated. The inventory tool consists of two parts: one related to the identification and designation of the geomorphosite, and a second, analytical part. The first one includes basic information about the geomorphosite, the official name, and other denominations and the record indicative, that consists of the letters GS, indicative standing for the Geosite, and a number, representing the place it occupies in the hierarchy of the region's geomorphosites, for example, GS_1 for Sabie Falls, GS_2 for Lone Creek Falls, GS_3 for Bridal Veil Falls, etc. Basic information about the general location within the region and the territorial-administrative units are also mentioned here, as well as other data such as coordinates.

Afterwards, the main features of the geomorphosite, typology and spatial extension were noted, features essential for the characterization of the geomorphosite and are the basis for further analysis of more specific characteristics. The geomorphosites were classified using complexity as a criterion: simple geomorphosites (e.g. Bridal Veil Waterfall), complex geomorphosites, which group up a series of valuable elements and that cannot, however, be considered geosites and systematic geomorphosites, geomorphosites of greater dimensions that contain smaller geomorpsosites. The generic type of landform represented by the site is also mentioned. The general value, structural and functional values, as well as the restrictive attributes, are indicated in this part, to create a first insight on the relevance of the analyzed geomorphosite. A representative photograph or map of the area are attached (Figure 2).

The second part of the tool covers the criteria used in the evaluation and allowed the assessor to explain the rates given for different criteria. Although many of the proposed criteria are objective, using quantitative scales, however, subjectivity can always occur. Thus, the justification of the rates is an effective way to minimize it. This second part consists of three distinct sections, reflecting the three aspects evaluated in the assessment method: structural and functional values and restrictive attributes. For each of them, every criterion was explained, every positive score justified.

INVENTORY TOOL FOR GEOMORPHOSITES		
NAME	BOURKE'S LUCK POTHOLES	
INDICATIVE CODE	GS_{10}	
LOCATION		
TYPOLOGY		
EXTENSION		
GENERAL VALUE		
STRUCTURAL VALUE		
FUNCTIONAL VALUE		
RESTRICTIVE ATTRIBUTES		
STRUCTURAL VALUE		
VALUE	Pt	JUSTIFICATION
GEOMORPHOLOGIC		
AESTHETIC		
ECOLOGICAL		
FUNCTIONAL VALUE		
TYPE	Pt	
CULTURAL		
SCIENTIFIC		
ECONOMIC		
EDUCATIONAL		
RESTRICTIVE ATTRIBUTES		
SCORE	JUSTIFICATION	
DEGRADATION RISK		
SCORE	JUSTIFICATION	

Figure 2. Inventory tool for the assessment and inventorying of geomorphosites along the Panorama Route

The inventory tool was designed to be dependent on the achievement of assessment and ranking of territorial relevant geomorphosites. Thus, the evaluation, ranking, and inventory of geomorphosites come together in a fluent and articulate approach of high objectivity and applicability.

Results

A total of 15 potential sites were selected for further assessment, these formed the basis of the inventory of geomorphosites along the Panorama Route. The results of the numerical assessment and ranking are presented in Table 1.

Table 1. Numerical assessment results and ranking of geomorphosites along Panorama Route

	(ScV)	(AdV)	(GmV)	(UsV)	(PrV)	(MTV)	(TV)	(Rk)
God's Window (GS7),	5,5	4,5	10	7	3	10	20	1
Bourke's Luck Potholes (GS10)	5,5	4,5	10	7	3	10	20	1
Blyde River Canyon (GS11),	5,5	4,5	10	7	3	10	20	1
Three Rondavels (GS12),	5,5	4,5	10	7	3	10	20	1
Pinnacle (GS6),	5,5	4,1	9,6	6,4	3	9,4	19	5
Eco Caves (GS13),	5	4	9	7	3	10	19	5
Sudwala Caves (GS15)	5	4	9	7	3	10	19	5
Lone Creek Falls (GS2),	4,7	4,4	9,1	6,9	2,5	9,4	18,5	8
Bridal Veil Falls (GS3),	3,6	4,1	7,7	6,6	3	9,6	17,3	9
Sabie Falls (GS1),	3,2	4	7,2	6,9	2,5	9,4	16,6	10
Mac-Mac Falls (GS4),	3,3	3,8	7,1	6	3	9	16,1	11
Lisbon Falls (GS8),	3	3,9	6,9	6,5	2	8,5	15,4	12
Berlin Falls (GS9),	3	3,9	6,9	5,9	2	7,9	14,8	13
Long Tom (GS14),	2,8	2,2	5	5,8	2,5	8,3	13,3	14
Jock of the Bushveld (GS5),	2,8	3,8	6,6	5,1	1,5	6,6	13,2	15

Note: GS_1 = Geomorphosite; ScV = Scientific Value; AdV = Additional Value; GmV = Geomorphic Value; UsV= Use Value; PrV= Protection Value; MgV= Management Value; TV= Total Value and Rk= Final Ranking

God's Window (GS_7), Bourke's Luck Potholes (GS_{10}) Blyde River Canyon (GS_{11}) and Three Rondavels (GS_{12}) are the most valuable geomorphosites along the Panorama Route. Their scores are the highest in total value and final ranking. These are 'panoramic viewpoints' followed by Pinnacle (GS_6) which is a 'panoramic viewpoint' with Eco Caves (GS_{13}) and Sudwala Caves (GS_{15}) being the tow caves of significance.

Whereas the areas are predominantly characterized by panoramic views (Table 3), landforms with high Use Value (UsV) with a score value of 7 reflecting a touch of pragmatism constitute the single places. From these panoramic views a great variety of landforms area observed. The main landforms along the Panorama Route are mostly tectonic or residual in character (DEA, 2017).

Tables 1 and 2 present the numerical assessment and ranking of geomorphosites results of the study area. Four geomorphosites are shown to be the most valuable sites with the highest scores in total value and final ranking and also coming first in '*geomorphological value'* and also first in '*management value*'. GS_7. GS_{10}, GS_{11}, GS_{12}, GS_{13}, and GS_{15} are strongest in terms of "*management value"* and four of these scored highest in terms of '*total value'* and the final ranking. Of these sites, GS_{13} and GS_{15} are only slightly different between their total value and final rankings.

The selection of ten geomorphosites for promotion was supported by the quantification stage, in particular, for their inclusion in touristic activities of the province as geological heritage sites. The results of the final ranking influenced the selection predominantly, although it did take into account the results of individual indicators.

Table 2. Results of geomorphosite numerical assessment along the Panorama Route

	ScV	AdV	GmV	UsV	PrV	MgV	TV
Sabie Falls (GS1),	3,2	4	7,2	6,9	2,5	9,4	16,6
Lone Creek Falls (GS2),	4,7	4,4	9,1	6,9	2,5	9,4	18,5
Bridal Veil Falls (GS3),	3,6	4,1	7,7	6,6	3	9,6	17,3
Mac-Mac Falls (GS4),	3,3	3,8	7,1	6	3	9	16,1
Jock of the Bushveld (GS5),	2,8	3,8	6,6	5,1	1,5	6,6	13,2
Pinnacle (GS6),	5,5	4,1	9,6	6,4	3	9,4	19
God's Window (GS7),	5,5	4,5	10	7	3	10	20
Lisbon Falls (GS8),	3	3,9	6,9	6,5	2	8,5	15,4
Berlin Falls (GS9),	3	3,9	6,9	5,9	2	7,9	14,8
Bourke's Luck Potholes (GS10)	5,5	4,5	10	7	3	10	20
Blyde River Canyon (GS11),	5,5	4,5	10	7	3	10	20
Three Rondavels (GS12),	5,5	4,5	10	7	3	10	20
Eco Caves (GS13),	5	4	9	7	3	10	19
Long Tom (GS14),	2,8	2,2	5	5,8	2,5	8,3	13,3
Sudwala Caves (GS15)	5	4	9	7	3	10	19

Note: ScV = Scientific Value; AdV = Additional Value; GmV = Geomorphic Value; UsV= Use Value; PrV= Protection Value; MgV= Management Value; TV= Total Value and Rk= Final Ranking

Discussion

This study is focused on the selection and description of geomorphosites process. The tool that we propose reflects with exemplary applicability the criteria used in the assessment method in estimating the different values (geomorphological, aesthetic, ecological, cultural, scientific/educational, and economic) that have been assessed. The analysis achieved using such a tool has resulted in the assessment and inventorying of the geomorphosites in the along the Panorama Route of Mpumalanga Province, South Africa. The inventory tool for the 12 geosites shows the geomorphosite with the highest score, confirming four of them as occupying the highest slot on the ranking list.

The approach takes both qualitative and quantitative aspects into account and allows for a holistic and detailed assessment of geomorphosites de Lima et al. (2010), Panizza (2001) and Chingombe (2019). Ever since the establishment of the Geomorphosite Working Group of the International Association of Geomorphologists in 2001 (Coratza & Reynard, 2005), several authors have carried out geomorphosite assessments using quantitative methods (e.g. Bonachea et al. 2005; Pralong 2005 and Serrano & Gonzalez- Trueba, 2005). Their studies emphasize the use of numerical assessment given its increasing objectivity of results, however, the more subjective and often unsystematic process of selection of landforms to be assessed does not seem to have received its due attention.

This paper argues that an element of subjectivity is present at all stages of an assessment and, in particular, during the selection phase of inventory compilation. Subjectivity is difficulty to be avoided even during the quantification stage as the values allocated for the criteria depended on the opinion of the assessor. The paper further argues that numerical assessment is propagated as a means of reducing subjectivity to increase the objectivity of geomorphosite comparison and achieve a general assessment.

The approach adopted in this study is an adaptation of de Lima et al. (2010) model puts greater emphasis and demands on the expertise of the assessor by including scientific/educational, non-scientific criteria and the degradation risk criteria for judgment as additional criteria to be used for numerical quantification and assessment.

The criteria proposed for the numerical assessment were taken from existing literature on the field. Criteria considered most relevant for an assessment method focussing specifically on geomorphosites were chosen and divided amongst the seven main types of indicators: geomorphological; scientific/educational; ecological; cultural; aesthetic; degradation risk and economic. The scientific/educational value, rareness, integrity, representativeness, and diversity were selected while on the other hand the criteria like size and age were not considered because they were not seen as significant to warrant their inclusion. The additional values criteria which took into consideration the cultural, aesthetic and ecological aspects were considered too. The use-value was strongly considered in terms of accessibility and visibility of the geomorphosite as these reflected the economic/ tourism needs. The final indicator focused on the present levels of deterioration and expected damage due to geomorphosite use and these then expressed the degradation risk.

According to the inventory tool, the study affirms that inventory and evaluation of geosites is the best way to tackle and to overcome the challenge associated with the implementation of the geoconservation along the Panorama Route, the completion of the inventory of each geosite promotes its scientific value (rarity, integrity and diversity) (Reynard et al., 2007). Furthermore, the inventory data brings additional explanation of the geology for scientists and promote local and international tourism, and attract visitors (Jaafar et, al., (2014).

Geosites along the Panorama Route could be used as additional aesthetic, ecological and cultural values (Randrianaly et. Al., 2016; Joyce, 2010) for example, the deep evergreen canyon in Blyde River Nature Reserve is considered as a natural beauty because of the landscape with the Three Rondavels. The potential of the geosites highlighted in this study shows the potential for geotourism the sites have and a sustainable strategy towards the ecotourism for the Panorama Route, which may help reduce poverty and may improve and create more sustainable development. These results demonstrate that inventorying geosites are not only restricted to scientific researches but also help to promote the educational, socio-cultural, ecological values of the Panorama Route.

Conclusion

The criteria used to differentiate between the selection of geomorphosites and their quantitative assessment is not a straightforward process. In the elaboration of inventories of geomorphosites, the emphasis has been placed on the assessment, selection, and evaluation methods as well as on cartographic representations. Not all of these methods include an evaluation or inventory tool as some just aim at the quantitative evaluation of the sites. However, not all of the tools used together with the assessment methods reflect the criteria or even the conclusions of the evaluative process, basically starting a new assessment approach. There are, however, some other tools purely descriptive, not based on a valuation method, while other tools are in themselves a method, containing a great number of criteria that allow the detailed evaluation of geomorphosites.

The assessment tool proposed in this study and its approach allows all data collected from the initial qualitative assessment to the final quantification to flow into the final results. The methodology allows the reduction of subjectivity, particularly in the qualitative stage and can be applied to other areas of Mpumalanga Province independent of size.

We have argued not only for the combination of quantitative and qualitative evaluation procedures but for equal weighting of management and scientific aspects and factors. The approach implemented for the assessment of the Panorama Route as an example would have been equally effective for the definition of sites with either greatest '*geomorphological value*" or with best '*tourism potential'*.

The uses of this inventory tool have resulted in the creation of a digital database that integrated geomorphosites of special interest in the area. These prototypes can be published online in other media to promote the disclosure of all necessary information to implement improve the geotourism sector. The inventory demonstrates that it is possible to apply the same thematic areas in the whole province which are so distant and different.

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References

Bonachea, J., Bruschi, V., Remondo, J., Gonzalez- Diez, A., Salas, L., Bertans, J., Cendrero, A., Otero, C., Giusti, C., Fabbri, A., Gonzalez-Lastra, J. & Aramburu, J. (2005). An approach for quantifying geomorphological impacts for EIA of transportation infrastructures: a case study in northern Spain. – In: *Geomorphology*, 66, 95-117.

Brilha, J. (2015). Inventory and quantitative assessment of geosites and geodiversity sites: A review. *Geoheritage*, 8,119-134.

Bruschi, V. M., Cendrero, A. (2005). *Geosite evaluation: can we measure intangible values?* in: Il Quaternario, *Italian Journal of Quaternary Sciences*, 18(1), 293-307.

Bruschi, V.M. & Cendrero, A. (2009). *Direct and parametric methods for the assessment of geosites and geomorphosites*, in Reynard, E., Coratza, P., Regolini-Bissig G. – editors, *Geomorphosites*, Verlag Dr. Friedrich Pfeil, Munchen, pp. 73-88.

Chingombe, W. (in press). Preliminary geomorphosites assessment along the Panorama Route of Mpumalanga Province, South Africa. GeoJournal of Tourism and Geosites.

Cocean, G. (2011). Inventory cards for regionally relevant Geomorphosites, *Romanian Review of Regional Studies*, VII(1).

Cocean, G. (2012). The inventory and hierarchy of geomorphosites in the Vlădeasa Massif, *Rev. Roum. Géogr. /Rom. Journ. Geogr.,* 56(2), 175–181.

Coratza, P. (2003). *Siti geomorfologici: ricerca, valutazione e valorizzazione, Esempi in Emilia-Romagna* [Geomorphological Sites: Research, Assessment and Development, Examples in Emilia-Romagna] - Tesi Dottore Ricerca, Universita Modena e Reggio Emilia.

Coratza, P. & Giusti, C. (2005). *Methodological proposal for the assessment of the scientific quality of geomorphosites*, in: Il Quaternario, *Italian Journal of Quaternary Science,* 18(1), 307-314.

De Lima, F.F., Brilha, J.B. & Salamuni, E. (2010). Inventorying geological heritage in large territories: A methodological proposal applied to Brazil*, Geoheritatge,* 2,91-99. Springer-Verlag. DOI 10.1007/s12371-010-0014-9.

Department of Environmental Affairs (DEA). (2017). Barberton Makhonjwa Mountain World Heritage Site Nomination Dossier, Registered geological sites. Appendix B

Giusti, C. & Calvet, M. (2010). The inventory of French geomorphosites and the problem of nested scales and landscape complexity. *Geomorphol-Rel Proc Environ,* 16(2), 223–244. DOI:10.4000/geomorphologie.7947.

Jaafar, M., Nordin, A.O.S., Abdullah, S. & Marzuki, A. (2014). Geopark Ecotourism Product Development: A study on Tourist Differences. *Asian Social Science*, 10, 42-55. http:dx.doi.org/10.5539/ass. v10n11p42.

Joyce, E.B. (2010). Australia's Geoheritage: History of a study, a New Inventory of Geosites and Applications to Geotourism and Geoparks. *Geoheritage*, 2, 39-56. http://doi.org/10,1007/s12371-010-0011-z

Panizza, M. (2001). Geomorphosites: concepts, methods and example of geomorphological survey. *Chin Sci Bull* 46(1):4–6. DOI:10.1007/BF03187227.
Pereira, P., Pereira, D., Caetano, Alves, M.I. (2007). *Geomorphosite assessment in Montesinho Natural Park*, *Geographica Helvetica Jg*. 62, 2007/Heft 3, pp. 159-168.

Randrianaly, H.N., Di Cenci, A, Rajaonarivo, A. & Raharimahefa, T. (2016). A proposed geoheritage inventory system: Case study of Isalo National Park, Madagascar. *Journal of Geoscience and Environment Protection,* 4, 263-172. http://dx.doi.org/10.4236/gep.2016.45016.

Reynard, E. (2009). *The Assessment of Geomorphosites*, in Reynard, E., Coratza, P., Regolini- Bissig G. – editors, *Geomorphosites*, Verlag Dr. Friedrich Pfeil, München, pp. 63-71.
Reynard, E., Coratza, P. (2007). Geomorphosites and geodiversity: a new domain of research. *Geogr Helv*, 62,138–139.

Reynard, E., Coratza, P. & Giusti, C. (2011). Geomorphosites and geotourism. *Geoheritage* 3(3),129–130. DOI:10.1007/s12371-011-0041-1.

Reynard, E., Fontana, G., Kozlik, L. & Scapozza, C. (2007). A method for assessing scientific and additional values of geomorphosites. Geogr Helv 62(3), 148–158.

Serrano, E. & González-Trueba, J.J. (2005). *Assessment of geomorphosites in natural protected areas: The Picos de Europa National Park (Spain)*, in *Géomorphologie: Relief, processus, environment*, 3/2005 pp. 197-208.