South African Journal for Research in Sport, Physical Education and Recreation, 2014, 36(1): 229-251.
Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2014, 36(1): 229-251.
ISBN: 0379-9069

MANAGING ENVIRONMENTAL IMPACT OF BOULDERING AS A NICHE OUTDOOR-CLIMBING ACTIVITY

Johannes H. VAN DER MERWE & Unio JOUBERT
Department of Geography and Environmental Studies, University of Stellenbosch, Stellenbosch, Republic of South Africa

ABSTRACT

The paper proposes a normative management instrument to help environmental managers in the field of outdoor recreation and conservation limit the impact of sport climbing, bouldering in particular, as an action-sport activity. Evidence of the rising popularity of the bouldering sport and its associated impacts on natural-resource areas is presented. The model is applied to and tested in the Rocklands bouldering area of South Africa to demonstrate its efficacy. The instrument uses 58 test criteria to account for the maintenance of a resource's market appeal and resource sensitivity by capturing these aspects at three spatial scales: the bouldering area as a whole, its sub-fields and the individual boulders. The model should aid conservation authorities, owners of private climbing areas and the organised climbing fraternity to ensure long-term sustainability of the use of climbing resources. The research concludes that the instrument provides the means to manage a natural resource sustainably within local and even international contexts.

Key words: Bouldering; Nature-based tourism; Activity impacts; Management-model design and application; Rocklands bouldering area.

INTRODUCTION

Bouldering is an outdoor action sport, the conduct of which in natural settings has real and perceived environmental impacts. The focus in this paper narrows from an international vantage point on the sport to activity in the Rocklands bouldering area in the designated Cederberg Wilderness Area (CWA) of the Western Cape province of South Africa. Globally, demands for outdoor adventure on natural lands increase constantly, hold significant economic value (Kroeger & Manalo, 2007), and challenge existing policy and management structures for systematic knowledge about and understanding of new user groups, their preferences and their demands on the management of public land (Ewert *et al*., 2006).

Bouldering has been around for a long time (Gill, 1969), after originating simultaneously in Europe and the USA (Department of Conservation and Natural Resources, 2008), finding later and slower entry in Central and South America (Farrell & Marion, 2002), Africa and Asia. Participation has grown enormously with hundreds of thousands of participants practicing on every continent, in urban, rural and undeveloped environments (Ness, 2011). A boulderer is only equipped with a chalk bag (containing magnesium carbonate dust), and climbing shoes. Safety and protection are provided by a specially constructed foam laminate 2x1 m bouldering mat or pad (crash pad). A boulderer climbs a specific problem (series of

moves), preferably from a sit-start position with the pad absorbing the shock of any fall. The total height of a route averages 2 to 4 m (MCSA, 2005).

Bouldering impacts range from the physical to the social (MCSA, 2005; Attarian & Keith, 2008; Vaske & Donelly, 2008). Bouldering pads damage plants when draped over vegetation and rock-hugging trees have their branches removed to accommodate new problems. Although it is assumed that the chalk used in bouldering is washed away by the next rain (MCSA, 2005), its effect on cliff environments (lichens and other vegetation) is unclear (Cater *et al*., 2008). Rock art is known to be damaged by climbing activity. A number of sources (The Access Fund, 2001; Attarian, 2002; Cole, 2004b; Frauman *et al*., 2010), summarise and expand on the potential impacts of bouldering and the responses by managers to these. Pristine wilderness does not persist around bouldering sites (Ness, 2011), and the sport is not static in time and space. New bouldering routes are constantly being explored and developed. The impacts from bouldering on these natural areas have not received sufficient attention in the management literature (Cater *et al*., 2008), although they have recently become the focus of more detailed analysis (Pickering & Hill, 2007; Porucznik, 2009).

Trampling is a universal problem on the outdoor recreation and conservation interface (Ross, 2006; Pickering & Hill, 2007; Zhong *et al*., 2011). The biodiverse Fynbos Biome is especially susceptible in the Cederberg. The Mountain Club of South Africa (MCSA) (2005:11), claims many climbing routes and boulders are "located above rock platforms and there is no or extremely limited vegetation loss in these areas". Evidence of trampling has, however, compelled CapeNature to begin systematic monitoring and remedial measures there (Hanekom & Davids, 2011). South Africa has become a premier destination for local and international boulderers, since it boasts one of the five top internationally ranked sites at Rocklands. The Internet and reputable glossy publications (Lourens & Igesund, 2010; Noy, 2010; Maddison, 2011), popularise its fame and attraction as an outdoor activity centre and bouldering destination. At Rocklands an estimated one-third only of the climbers obtained climbing permits (Hanekom & Davids, 2011), and at the De Pakhuys control gate the number of entrants totalled over 600 during the recent five-month climbing season, which is a continuation of a trend of annual doubling in numbers (Kruger, 2011). It responds to the call for research to give strategic attention to the natural resources crucial for sustainable ecotourism (Crispin & Wickham, 2010), and visitor-management strategies by formulating indicators and standards for ensuring quality visitor experience (Adamovics *et al*., 2003; Manning *et al*., 2005).

PURPOSE

This paper addresses the Monz and Leung (2006) challenge to parks management to maintain natural resources and allow an unconfined visitor experience by monitoring trends in visitor use and resource condition, through collecting, processing and monitoring information.

METHODOLOGY

Data sources and fieldwork

Cole and Wright (2003) record a paucity of data on US wilderness visitors and their recreational impacts, and they emphasise the great value of the various types of baseline data

obtained for this study. An extensive Internet search confirmed the high standing of the Rocklands area in the local and international bouldering communities. To complement literature surveys, one author (Joubert) spent 4 months doing participatory observation while bouldering at various locations in the Western Cape, particularly in the Cederberg Rocklands area. He gained intimate knowledge of the life worlds of climbers and the factors determining the market appeal of bouldering locations. Primary empirical information on the location of specific boulder problems was acquired, as well as an understanding of management issues. Boulder-morphological data used for evaluating problem locations were sourced from Loskott (2005) and Bouldering SA (2006), as well as SACIN (2006) for the various boulder fields. Empirical observation and participation provided unique supplementary data.

Semi-structured personal interviews with the staff of management agencies and the climbers informed the construction of the Bouldering Market Appeal and Sensitivity Gauge (BMASG). The prototype instrument was e-mailed to select members of the MCSA for deliberation and their suggestions. After refinement the BMASG was applied to 523 individual problems located in 16 of 24 demarcated boulder fields in the Rocklands area to assess the robustness and practicality of the model (Joubert, 2006). In-depth interviews with officials of CWA (nature conservator and tourism coordinator) at CapeNature in 2011 yielded management information. The owner of De Pakhuys farm, on which most of the eastern sector's boulder fields are located, and operator of Camp Sallie, was interviewed and a 1 year registration data set for analysis.

Spatial framework of bouldering activity

Studying the impacts and management of bouldering activity and visitation on outdoor resources (Bateman *et al*., 2003; Cole & Monz, 2004), requires special attention to the spatial dimension of activity zones (Porucznik, 2009). The study of bouldering as adventure-sport tourism is best approached using the spatial framework for Rocklands graphically defined in Figure 1.

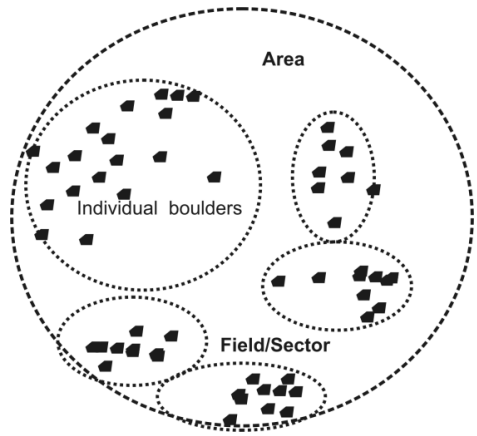


***FIGURE 1*: GENERIC EMBEDDED RESOLUTION OF BOULDERING MANAGEMENT UNITS**

The bouldering fraternity distinguish 24 separate fields in designated northern, eastern and 2 southern sectors. The southern sectors are located in the CWA managed by CapeNature, the eastern section is on private farmlands (De Pakhuys and two neighbours), and the northern sector is on mixed private and CWA land. The distinction between continuous fields is often problematic and single boulders or small rock formations may have only 1 or numerous individual problems on them. For instance, on the Dihedral Boulders, more than 70 problems have been isolated (De Pakhuys Dihedral Bouldering, 2011; Janata, n.d.). Not all boulders are this rich, but richness and hence popularity are enhanced by the variety and number of problems in close proximity.

This spatial subdivision allows permit or gated restriction to individual boulders or fields in an area, either to restrict or encourage access and to allow remedial actions or rest periods for stressed areas. Boulder problems are generally grouped into 7 morphological variants: arête, dyno, face, high-ball, roof, slab and traverse (see Appendix A for explanations). The dominant variant determines the problem's variant status. Roof, face and slab allude to the structure of the problem and traverse and dyno to the nature of the movements required to complete the problem. High-ball refers to the possible height of a climber's fall. Other variants exist, but are subsumed under these 7.

RESULTS

In this section a discussion of the theoretical requirements for and typology of the model precedes an exposition of the design particulars of the model and concludes by reporting the results of the model's application to the Rocklands boulder area.

Normative bouldering-management model

The tenets of the model are sustainable management of an outdoor activity resource through participant partnership; evaluation of the appeal to the tourism market; and the resilience of a resource underutilisation. Accordingly, a normative management model must account for resource commodification, product development, product-value assessment, maintenance sustainability, education of participants and managers, and aiding of partnership formation.

Bouldering assets comprise individual boulders, their problems and the pathways providing access to them. Problem concentrations at meso-scale and macro-scale increase boulders' commodity value as ecotourism resources (Johnston & Edwards, 1994). Commodification is the process by which objects and activities become evaluated primarily for their exchange value in trade (Cohen, 1988). Bouldering assets are tacitly commodified since the natural environment is not altered by the act of climbing, merely used interactively. The activity creates value by generating a sport-cultural heritage via the human–nature interactions packaged for tourists within the paradigm of new adventure sports that do not resist authentic touristification. Climber tourists visit bouldering areas, such as Rocklands, for extended periods (MCSA, 2005), solely to participate in this outdoor activity.

The development[1] of bouldering resources for tourism usually lacks economic motive. Natural heritage in the form of small rock formations and natural boulders is the resource for the creation of a sport-cultural heritage by climbing and holds steady, long-term income value (MCSA, 2005; Kruger, 2011), if used and managed sustainably. Many landowners in and managers of regions rich in bouldering resources in the Western Cape, where favourable geological structures occur in the sandstones of the Cape Supergroup, have had little exposure to bouldering activities. Wurz and Van der Merwe (2004:10) recognise that "… as is the case in any resource-consuming industry, the maintenance of resource integrity is paramount in ensuring the sustainable use of that resource for posterity".

The integrity of bouldering resources alludes to impacts on the boulders and their natural, cultural and social environments. The *natural* component refers to the impact on ecological processes, biological diversity and the rock formations; the *cultural* component relates to impacts on tangible cultural heritage such as archaeological artefacts; and the *social* component concerns relationships between boulderers, local communities and land managers. The use of a principle-based notion of sustainability is more holistic and concrete than the 3-tier triple bottom line (environmental, social and economic) model of sustainability. These principles are embedded in the BMASG criteria which focus on the economic and environmental pillars of sustainability and to a lesser extent the social or community dimension due to its relatively isolated natural location. Yet, understanding the social component of bouldering is vital to managers and developers (Frauman *et al*., 2010), for assessing the value of the resource and marketing it effectively.

Wilderness and areas of world heritage are being targeted worldwide for ecotourism and, crucially, remaining mountain wilderness in South Africa is poorly protected (Shroyer & Blignaut, 2001). Nature remains undervalued in the absence of valid knowledge about authentic natural and cultural environments, although a range of economic valuation techniques do exist (Grijalva & Berrens, 2003). Consequently, participation by and education of the climbing community, landowners and managers, constitute the foundation for application of the sustainable management principles embedded in the BMASG. It is essential to understand and direct tourist behaviour where cultural heritage is involved. Through education, the concept of minimal impact is implied and thus assessment of the sensitivity of a specific location must precede development. The BMASG has the task to educate all participants, boulderers and managers alike, about the bouldering phenomenon.

The impacts of climbing activities increase in proportion to the numbers of climbers participating; hence limits on user numbers substantially minimise the impacts of the activities. Nevertheless, the most successful approach to managing bouldering sustainably is by building a strong partnership between local climbing organisations and land managers. The climbing community supports environmental stewardship to maintain a sustainable climbing experience where ecologically, economically and ethically responsible destination managers, stakeholders and tourists practice appropriate planning, monitoring, evaluation,

[1] Development refers to a boulderer (opener) or team officially opening a new problem, boulder, field or area by climbing where no previous climbing has been done, documenting particulars and introducing it to the climbing fraternity, probably after clearance with owners or management.

and management of nature-based tourism or ecotourism (Deng *et al*., 2002). The BMASG mechanism is geared to facilitate efforts to achieve this sustainability in the sport of bouldering.

Bouldering Market Appeal and Sensitivity Gauge (BMASG)

The BMASG is a management instrument which incorporates the principles established above. The following discussion first unravels the technicalities of this normative approach and then applies the relevant criteria sets to each spatial bouldering domain.

Normative approach

A successful resource-management instrument should establish standards to realise management objectives. Science contributes to discovering appropriate normative standards for visitor experiences and levels of resource impact. Managers require normative data to develop evaluative standards for impact management (McDonald, 1996), that is a domain beyond the reach of science, but in the realm of management (Cole, 2004a). Here an effort is made from the angle of science.

The search for norms in social outdoor behaviour (Donnelly *et al.*, 2000), has been more rigorously pursued than for the physical norms used. The instrument has to fit into a wilderness-management framework (Farrell & Marion, 2002), or environmental management system (EMS), as a performance-monitoring tool (Moore *et al*., 2003). The BMASG is designed for use by a local management agency (CapeNature), much like EMSs have become established in local authorities elsewhere as less formal, locally-adapted regulative and normative instruments (Emilsson & Hjelm, 2004; 2005).

The gauge is designed to systematically evaluate bouldering locations on an asset-by-asset basis regarding 2 dimensions: their market appeal for boulderers and their ecological resilience to bouldering use at "the convergence of tourism and recreation in an adventure setting" (Pomfret, 2006:114). Assets are evaluated by measurable criteria on 3 scale units, namely individual boulder problem, boulder field and boulder area. The instrument approaches the evaluation challenge from an intimate perspective of bouldering as an activity, rather than just an impact-assessment (Porucznik, 2009). Market appeal to visitors is paramount in the tourism industry, but for conservation management the sensitivity and authenticity of the resource are fundamental. Climbers derive value from the total bouldering experience, which can be significantly diminished by a degraded environment, leading to the loss of its asset-market value (MCSA, 2005).

The BMASG is designed to determine the level of management needed, should be demanded, or be imposed on bouldering locations. Whereas management normally targets individual fine-scale boulder problems, staging areas and access trails, successful marketing demands a coarser resolution viable at the area-scale of regional marketing strategies. Marketing single boulder problems is inefficient, rather an area packaged with concentrations of numerous sets of boulder fields and a multitude of problems. The instrument encapsulates these requirements in 30 significant, purposeful, measurable, readily determinable and non-technical criteria applicable at the spatial and temporal scales at which visitor activities (and their effects) occur (Hadwen *et al*., 2008).

The grading principle of Wurz and Van der Merwe (2004) was adapted for simplicity of use, intuitive understanding, uniform application and a wider adoption in rapid-survey methods (Porucznik, 2009). It recognises the concept of variation in the prevalence, importance, and stability of normative standards at different social or management contexts (Vaske *et al*., 1993; Kuentzel *et al*., 2008). An uncomplicated 4-value scoring range (0=None, 1=Low, 2=Moderate, 3=High) is applied to criteria according to the anticipated degree of vulnerability-robustness and experience rating.

The rating principle is unambiguous, thus the higher the rating score, the higher the marketability, significance and vulnerability. Values also measure and reflect management obligation, hence the higher the score, the more obligatory and stricter the management measures imposed. The rating system integrates the criterion values to produce a specific index reflecting sensitivity and marketability for each of the 3 spatial-resolution variants. Each indicator set is completed with an indexed indicator of mean scores for that subset to consolidate the overall score set. This meets the practical requirement of limiting monetary cost, saving staff time and providing management with an uncomplicated measurement protocol, which is a new approach to a set of importance-performance indicators (Newman *et al*., 2001; Monz & Leung, 2006).

Criteria for individual boulder problems

These criteria evaluate the smallest or micro-scale units according to market appeal and sensitivity to damage. The following expositions of the Bouldering Market Appeal and Sensitivity Gauge (BMASG), patterned on the formulations in Appendix A, are necessarily technical and use the climbing fraternity's terminology.

Criteria for boulder market-appeal

Criteria for boulder market appeal constitutes rock quality, fall danger (Beedie & Hudson, 2003), and nature of boulder problems (Hanley & Wright, 2003). Nature of boulder problems constitutes the reputation value of the boulder problems, aesthetics of a boulder-problem line, problem grade, number of possible crux sequences of similar grade, degree of eliminate and ease of access (Hanley & Wright, 2003). Criteria for boulder sensitivity agree with those of Porucznik (2009) for evaluating climbing impacts. They take into account the presence of archaeological sites, damage to problems and damage to staging areas (MCSA, 2005; The Access Fund, 2006).

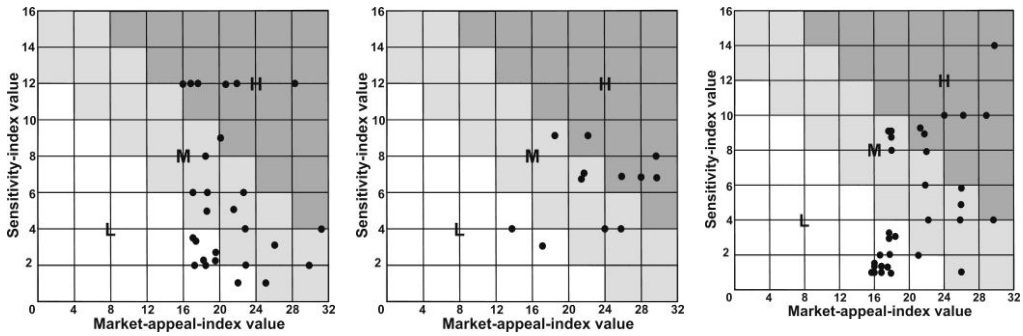
Boulder-field criteria

Examples of boulder-impact evaluation (Hanley & Wright, 2003) (boulder-field criteria), have been performed at field resolution or even at the coarser bouldering area resolution. Criteria for the meso-scale boulder-field unit are subdivided according to market appeal and sensitivity. The criteria represent aggregate and synoptic measures of characteristics deemed to guide management at this coarser spatial resolution. Criteria for boulder-field market appeal include the index value for boulder-problem attraction, boulder-problem component and spatial component while the criteria for boulder-field sensitivity include an ecological and cultural-sensitivity, as well as a field management component.

At macro-scale the bouldering area is evaluated on aggregate market appeal and sensitivity values derived from the nested micro-scale (boulder) and meso-scale (field) criteria measurements. This integrates the social and resource indicators essential for meeting management mandates to protect experiential and resource conditions (Newman *et al*., 2001). The boulder-area criteria constitute the criteria for boulder-area market appeal (index value of boulder-field attraction, spatial-area and bouldering components) and boulder-area sensitivity criteria (Vaske & Donnely, 2002; Wurz & Van der Merwe, 2004).

Results of the application to Rocklands

The BMASG index values are quantitative indicators of bouldering assets on a management-marketing continuum. Plotting the scores of individual boulder problems on axes for market appeal and sensitivity in a two-dimensional diagram, demarcates adjustable high (H), medium (M) or low (L) management-need segments and problems designated according to their plotted locations (Figure 2). Diagrams for fields reflect the need for management at field level, thus integrating sensitivity and market-appeal indicators to register management requirements, while recognising that bouldering might not be appropriate in all areas (The Access Fund, 2006), and that bouldering impacts increase in gravity with increasing climber numbers (MCSA, 2005). The reach of the 3 management segments can be adjusted according to management-agency policy mandate to control bouldering impacts. The maximum index values for sensitivity and market appeal in these diagrams were obtained from Rocklands applications. Figure 2 demonstrates applications in 3 fields being 1 from each recognised bouldering sector (an eastern and 2 southern sectors).



a. Dihedral Boulders (Field 14) b. Ceder Rouge (Field 10) c. Riverside (Field 2)

***FIGURE 2*: BMASG APPLICATION PLOTS FOR INDIVIDUAL BOULDERS IN THREE REPRESENTATIVE BOULDERING FIELDS IN ROCKLANDS BOULDERING AREA**

Examples demonstrate sufficient variance in plot patterns and hence differences in management requirements for fields and individual boulders. The aggregated meso-scale bouldering-field criteria were plotted in Figure 3 using BMASG index scores for 16 of the fields.

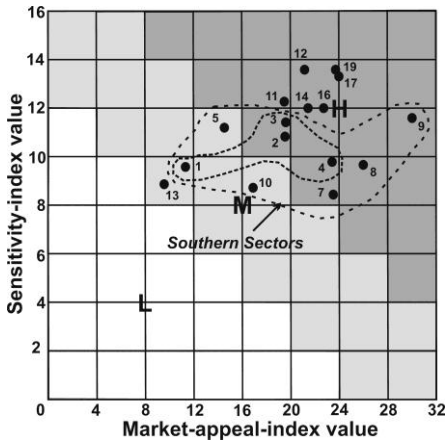


***FIGURE 3*: BMASG PLOTS OF MANAGEMENT NEED FOR BOULDERING FIELDS**

The plotted results show a concentration of fields in the high-management demand section of the diagram, with 12 fields flagged for such attention, 4 at medium level and none in the low-management category. It is significant that fields in the 2 southern sectors congregate in the relatively lower sensitivity and market-appeal section of the continuum, whereas the eastern sector's fields, with the exception of field 13, rate higher on both axes. This alignment is significant from a management perspective because the southern sectors are managed by CapeNature (public authority), while the eastern sector is under private ownership, where commercial exploitation of bouldering potential is more keenly driven. The plot pattern shows sensitivity and market appeal largely balanced in most fields, which is indicative of model design and calibration of index criteria that facilitate objective judgement.

The results show that the instrument and its application may be overly sensitive, perhaps justifiably so in this highly rated conservancy and wilderness area. Moreover, by design the evaluators did not represent a specific user-interest group hence recalibration under operational circumstances is likely. The model should reflect the joint management preferences and aims to encompass the local user community consisting of landowners, land managers, local authorities, local communities and the bouldering fraternity and to adjust to the needs of each unique bouldering area.

DISCUSSION: BOULDERING-RESOURCE MANAGEMENT IN THE CEDERBERG

Several implications flow from the research outcomes. Bouldering is confirmed as a real-world issue with increasing impact intensities and extent worldwide that is insufficiently recognised in official policy and management strategies, especially in South Africa. Though Shroyer and Blignaut (2001) asserted that developments and poor management practices on private and government land were rife in South African mountain areas, and that mountain wilderness was shrinking, they made no reference to bouldering as an impacting outdoor activity. Even the comprehensive management plan compiled for the Cederberg (Western

CapeNature Conservation Board, 2002), ignored the boulderer as a valuable niche-outdoor recreationist (Pomfret, 2006; Kruger, 2011).

The BMASG seamlessly slots into the broad management suite required to address bouldering as a generator of environmental problems. The model, its constituent criteria, application methodology and results are the tangible legacy of the research and it should find application and have an effect on eight aspects of regional natural-resource management.

In its narrower application context the BMASG has the following outcomes:

- BMASG builds knowledge as an educational tool among boulderers as outdoor-climbing recreationists. The instrument is an educational and outreach tool for promoting low-impact use (Attarian & Keith, 2008), and identifying the needs for educational and directive signage called for by the Cederberg mountaineering plan (MCSA, 2005).
- BMASG raises inter-group awareness among all parties involved in or affected by outdoor-climbing recreation as a regional activity, primarily boulderers, community members and land managers. The MCSA management plan calls for measures that ensure a good recreational experience for climbers (MCSA, 2005), but lacks insight into development potential and management and ignores private land developments, as well as international bouldering tourists oblivious of sustainable-development practices. The BMASG is cognizant of common climber and tourism motives (Pomfret, 2006), rooted in escapism from everyday environments, routines and responsibilities.
- BMASG builds an understanding of boulderers as outdoor recreationists and reaches boulderers on e-platforms. The instrument's electronic format and its repository of evaluation information ensures that young boulderers with access to Internet sites devoted to their activity can be reached to support educational and outreach programmes in popular bouldering locations where initiatives are often in short supply (Pomfret, 2006; Attarian & Keith, 2008).
- BMASG formalises a management tool for gathering impact data systematically, monitoring recreational use and flagging application requirements for management measures. Since climbing impacts increase with increased climber numbers, the experiential quality of routes and ease of access that determine usage patterns of areas can be recorded as carrying-capacity data from the BMASG. Lack of data is a major hindrance to local planning (MCSA, 2005), that prohibits the monitoring and controlling of climber numbers permitted to use specific areas.

In its broad application context the BMASG performs several functions, namely:

- BMASG reconciles and integrates considerations of regional planning and the tourism and conservation sectors. The MCSA management plan specifically aims to minimise climbing impacts in the Cederberg, while maximising the benefits and ensuring a good recreational user experience (MCSA, 2005), yet it lacks foresight into regional development potential and management.
- BMASG facilitates monitoring of bouldering-activity impacts, regional tourism industry growth and development, and harvesting economic benefits and income generation. Understanding and managing bouldering as a unique form of outdoor recreation prevent

conflict with other resource values (The Access Fund, 2006), vital for successful planning. A plethora of bouldering-related issues requiring management are covered in existing international planning guidelines (National Park Service, 2002; The Access Fund [Boulder project in Department of Conservation and Natural Resources], 2006). Local and international actions, behavioural measures and environmental concerns are well known (MCSA, 2005; Cater *et al*., 2008), but management should adopt, what Parkin (n.d.) terms, Minimal Impact (MI) as a code of practice. The BMASG can be a pivotal instrument in engineering this adoption.

- BMASG structures planning and management responses or actions from land managers, landowners and authorities to target specific remedial rules. Current management plans for the Western Cape mountains, embrace coordination frameworks, like zoning and sustainable use focus on direct and indirect benefits, but they predate the Rocklands development, which commenced in 1996. Management elsewhere relies on access control by creating so-called long-walk-in policies (Hanley *et al*., 2002; 2003; Hanley & Wright 2003), but the denser path networks typical of bouldering require a higher level of management and they need to be more clearly demarcated; recommendations to which CapeNature has not yet responded. The MCSA management plan assigns responsibility for monitoring new boulder routes through an internal MCSA committee procedure (MCSA, 2005), but there is no existing basis for objective evaluation and approval, hence no systematic basis for approval, nor any criteria or requirements for applications for new routes. The BMASG provides these systematic, benchmarked process controls, so its use could be made compulsory in the application process with its scores used as conditions of approval as set in the MCSA (2005) plan. In time, it can be amended by the user fraternity in partnership with management.
- BMASG provides the interface where all involved parties raise concerns and see them acted on. It can be instrumental in building and maintaining management stewardship and partnerships essential for best practice in landscape-resource management (Western CapeNature Conservation Board, 2002). Partnerships cannot be realised without management collaborations, which address and validate the concerns of all stakeholders (Ewert *et al*., 2006). To CapeNature and the MCSA, functioning as a national federal body with solid national and international linkages (Schoon *et al*., 2001), adoption of the BMASG could be instrumental in realising their stated goals for bouldering as a variant form of climbing that is glaringly absent from the focus of both institutions.

CONCLUSIONS AND RECOMMENDATIONS

The BMASG instrument is new and innovative, but has certain shortcomings, of which the absence of clear benchmarking on criterion scores is one. Since collaborative agreement among scientists, management and the user community is paramount (Cole, 2004a), this element has to be improved by refining value judgments and standards applied. As part of the management decision-making frameworks to monitor site conditions, assessing management outcomes and increasing zoning efficiency to protect remote or pristine areas, the instrument would enhance managers' ability to assess, manage and minimise visitor impacts and establish the type of recommended management framework (Farrell & Marion, 2002), that allows participation by the public and members of expert panels. This outreach and participative aspect of management plans must embrace the climbing community through

active involvement and documentation of impacts to obtain the support of climbers (Attarian & Keith, 2008). Understanding the social component of bouldering practices and preferences (Frauman *et al.*, 2010), and valid measurement of boulderers' perceptions of and responses to policy change, call for thorough investigation (Adamovicz *et al*., 2003; Hadwen *et al*., 2008). The compatibility of bouldering with other types of land use (Attarian & Keith, 2008), must be exploited without ignoring potential conflicts (Hammitt & Schneider, 2000), and management practices and regulations aimed at conserving the resource boulderers depend on and favour (Nelb & Schuster, 2007), must be employed.

Finally, the spatial approach to analysing, comprehending and addressing the impacts of bouldering offers an efficient management solution. While concurring with the recommendation of Cater *et al*. (2008), for increased and intensified site monitoring and proactive development of site-specific management plans in consultation with climbing groups, we propose a stricter and technically-structured approach. A hierarchical spatial focus from the bouldering area as the overall management unit within which are nested measures for sectors, fields and even individual boulders is hereby recommended. This would allow for frequent monitoring of cumulative damage (Zhong *et al*., 2011), although initial management costs will increase (Attarian, 2002).

There is good reason to urge initial investment in a spatial geographical information system (GIS) database. In the Rocklands case, Noy (2010) laid the analogue map foundation for an operational tourism-cum-bouldering-activity platform for planning and information sharing. Capturing these in GIS produces a database of variable scale and 3D-embedment for the resolution of area, sector, field and boulder problems. The existing CapeNature GIS database could incorporate this information set to systematically plan and implement the MCSA's (2005) suite of monitoring requirements, including climber numbers (continuous), pathways (annually), sport-climbing and bouldering areas (six-monthly, fixed-point photography and rapid survey of vegetation). Fine-scale spatial monitoring is required since visitor impacts show spatial response patterns that must be regulated and managed (Cole & Monz, 2004). It helps management agencies to understand the extent of the resource, to monitor impacts ,and to model various management scenarios (Bateman *et al*., 2003; Gorman *et al*., 2008), as well as encouraging integrative analysis (Newman *et al*., 2001).

Nevertheless, management should guard against applying measures that mitigate against place making – the lived experience of an environment or spatial location – especially since boulderers typically prefer to have the boulders they climb located outside the constricting reach of proclaimed wilderness areas (the politics of place), because the climb, more than the environmental setting, interests them (Ness, 2011). Future research should provide greater clarity to the current grasp of the exceptional life-world of boulderers.

REFERENCES

ADAMOVICS, W.; SWAIT, J.; BOXALL, P.C.; LOUVIERE, J. & WILLIAMS, M. (2003). Perceptions versus objective measures of environmental quality in combined revealed and stated preference models of environmental valuation. In N. Hanley, W.D. Shaw & R.E. Wright (Eds.), *The new economics of outdoor recreation* (pp.165-189). Cheltenham (UK): Edward Elgar.

ATTARIAN, A. (2002). Managing groups at climbing sites. In R. Poff, S. Guthrie, J. Kafsky-DeGarmo, T. Stenger, & W. Taylor (Eds.), Proceedings of the 16th International Conference on Outdoor Recreation and Education (pp.20-27). Bloomington, IL: Association of Outdoor Recreation and Education.

ATTARIAN, A. & KEITH, J. (2008). "Climbing management: A guide to climbing issues and the production of a climbing management plan." Boulder, CO: The Access Fund. Hyperlink [http://www.accessfund.org]. Retrieved on 15 July 2011.

BATEMAN, I.J.; LOVETT, A.A.; BRAINARD, J.S. & JONES, A.P. (2003). Using geographical information systems (GIS) to estimate and transfer recreational demand functions. In N. Hanley, W.D. Shaw & R.E. Wright (Eds.), *The new economics of outdoor recreation* (pp.191-219). Cheltenham (UK): Edward Elgar.

BEEDIE, P. & HUDSON, S. (2003). Emergence of mountain-based adventure tourism. *Annals of Tourism Research*, 30(3): 625-643.

BOULDERING SA (2006). "Rocklands Topo's." Hyperlink [www.bouldering.co.za]. Retrieved on 1 October 2006.

CATER, C.; BUCKLEY, R.; HALES, R.; NEWSOME, D.; PICKERING, C. & SMITH, A. (2008). High impact activities in parks: Best management practice and future research. Technical report. Southport, Queensland (Australia): Cooperative Research Centre for Sustainable Tourism, Griffith University.

COHEN, E. (1988). Authenticity and commoditization in tourism. *Annals of Tourism Research*, 15: 371-386.

COLE, D.N. (2004a). *Carrying capacity and visitor management: Facts, values and the role of science*. Missoula, MT: Aldo Leopold Wilderness Research Institute.

COLE, D.N. (2004b). "Monitoring and management of recreation in protected areas: The contributions and limitations of science." Working Papers of the Finnish Forest Research Institute 2. Hyperlink: [http://www.metla.fi/julkaisut/workingpapers/2004/mwp002.htm]. Retrieved on 15 July 2011.

COLE, D.N. & MONZ, C.A. (2004). Spatial patterns of recreation impact on experimental campsites. *Journal of Environmental Management*, 70: 73-84.

COLE, D.N. & WRIGHT, V. (2003). Wilderness visitors and recreation impacts: Baseline data available for twentieth century conditions. General Technical Report RMRS-GTR-117. Rocky Mountain Research Station: United States Department of Agriculture, Forest Service.

CRISPIN, S. & WICKHAM, M. (2010). Ecotourism and strategic management: The current state of play. Paper read at CAUTHE Conference, 8-11 February 2010, Hobart, Tasmania, Australia.

DE PAKHUYS DIHEDRAL BOULDERING (2011). Hyperlink: [http://www.rocklandsboulders.com/rocklands-bouldering/PlateauArchValleyandDihedral]. Retrieved on 15 July 2011.

DENG, J.; KING, B. & BAUER, T. (2002). Evaluating natural attractions for tourism. *Annals of Tourism Research*, 29(2): 422-438.

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES (2008). Rock climbing, rappelling, and bouldering management policy and guidelines. Harrisburg, PA: DCNR.

DONNELLY, M.P.; VASKE, J.J.; WHITTAKER, D. & SHELBY, B. (2000). Toward an understanding of norm prevalence: A comparative analysis of 20 years of research. *Environmental Management*, 25(4): 403-414.

EMILSSON, S. & HJELM, O. (2004). Different approaches to standardized environmental management systems in local authorities: Two case studies in Gothenburg and Newcastle. *Corporate Social Responsibility and Environmental Management*, 11(1): 48-60.

EMILSSON, S. & HJELM, O. (2005). Development of the use of standardized environmental management systems (EMSs) in local authorities. *Corporate Social Responsibility and Environmental Management*, 12(3): 144-156.

EWERT, A.; ATTARIAN, A.; HOLLENHORST, S. & RUSSELL, K. (2006). Programs that work. Evolving adventure pursuits on public lands: Emerging challenges for management and public policy. *Journal of Park and Recreation Administration*, 24(2): 125-140.

FARRELL, T.A. & MARION, J.L. (2002). The Protected Area Visitor Impact Management (PAVIM) framework: A simplified process for making management decisions. *Journal of Sustainable Tourism*, 10(1): 31-51.

FRAUMAN, E.; SWING, W.; RABINOWITZ, E.; YOUNGMAN, J. & SNIPES, E. (2010). An investigation of South eastern boulderers' environmental and social practices. Boone, NC: Recreation Management Program, Appalachian State University.

GILL, J.P. (1969). The art of bouldering. *The American Alpine Journal,* 16(43): 355-357.

GORMAN, J.; PEARSON, D. & WHITEHEAD, P. (2008). Assisting Australian indigenous resource management and sustainable utilization of species through the use of GIS and environmental modelling techniques. *Journal of Environmental Management*, 86: 104-113.

GRIJALVA, T. & BERRENS, R.P. (2003). Valuing rock climbing and bouldering access. In N. Hanley, W.D. Shaw & R.E. Wright (Eds.), *The new economics of outdoor recreation* (pp.21-39). Cheltenham (UK): Edward Elgar.

HADWEN, W.L.; ARTHINGTON, A.H. & BOONINGTON, P.I. (2008). Detecting visitor impacts in and around aquatic ecosystems within protected areas. Technical report. Southport, Queensland (Australia): Cooperative Research Centre for Sustainable Tourism, Griffith University.

HAMMITT, W.E. & SCHNEIDER, I.E. (2000). Recreation conflict management. In W.C. Gartner & D.W. Lime (Eds.), *Trends in outdoor recreation, leisure and tourism* (pp.347-356). New York, NY: CABI Publishing.

HANEKOM, P. & DAVIDS, H. (2011). Personal communication with CapeNature conservation officials who were interviewed at Algeria Forestry Station on 16 September 2011.

HANLEY, N.; ALVAREZ-FARIZO, B. & SHAW, W.D. (2002). Rationing an open-access resource: Mountaineering in Scotland. *Land Use Policy*, 19: 167-176.

HANLEY, N.; ALVAREZ-FARIZO, B. & SHAW, W.D. (2003). Using economic instruments to manage access to rock-climbing sites in the Scottish Highlands. In N. Hanley, W.D. Shaw & R.E. Wright (Eds.), *The new economics of outdoor recreation* (pp.40-58). Cheltenham (UK): Edward Elgar.

HANLEY, N. & WRIGHT, E. (2003). Valuing recreational resources using choice experiments: Mountaineering in Scotland. In N. Hanley, W.D. Shaw & R.E. Wright (Eds.), *The new economics of outdoor recreation* (pp.59-73). Cheltenham (UK): Edward Elgar.

JANATA, M. (n.d.). "Bouldering guide: De Pakhuys Area, Rocklands, South Africa." Hyperlink [http://www.rocklandsboulders.com/rocklands-bouldering]. Retrieved on 15 July 2011.

JOHNSTON, B.R. & EDWARDS, T. (1994). The commodification of mountaineering. *Annals of Tourism Research*, 21(3): 459-478.

JOUBERT, U. (2006). Bouldering evaluation: Sustainable marketing and environmental management for outdoor activities. Unpublished Master's thesis. Stellenbosch: Department of Geography and Environmental Studies, Stellenbosch University.

KROEGER, T. & MANALO, P. (2007). "Economic benefits provided by natural lands: Case study of California's Mojave Desert." Washington, DC: Defenders of Wildlife. Hyperlink: [http://www.defenders.org/publications/mojave_economics]. Retrieved on 15 July 2011.

KRUGER, M. (2011). Personal communication from the private owner of De Pakhuys farm (primary host to bouldering activity), interviewed at De Pakhuys farm on 17 September 2011.

KUENTZEL, W.F.; LAVEN, D.; MANNING, R.E. & VALLIERE, W.A. (2008). When do normative standards matter most? Understanding the role of norm strength at multiple National Park settings. *Leisure Sciences*, http://www.informaworld.com/smpp/title~content=t713773100~db=all~tab=issueslist~branches=30 - v3030(2): 127-142.

LOSKOTT, K. (2005). "Topo's for bouldering at the Alpha Farms". Alpha Excelsior, Pakhuis Pass, South Africa. Hyperlink [http://www.alphaexcelsior.co.za/]. Retrieved on 15 July 2011.

LOURENS, T. & IGESUND, K. (2010). Rock your soul. *Country Life*, September, 50-53.

MADDISON, J. (2011). Bouldering in the Cederberg. *West Coast Escape*, Winter-Spring, 66-75.

MANNING, R.; LEUNG, Y-F. & BUDRUK, M. (2005). Research to support management of visitor carrying capacity of Boston Harbour Islands. *Northeastern Naturalist*, 12(3): 201-220.

MCDONALD, C.D. (1996). Normative perspectives on outdoor recreation behaviour: Introductory comments. Special issue Part 1, *Leisure Sciences*, 18(1): 1-6.

MCSA (MOUNTAIN CLUB OF SOUTH AFRICA) (2005). Environmental and access sport climbing and bouldering management plan: Cederberg Wilderness Area (Rocklands and Truitjieskraal). Cape Town: Mountain Club of South Africa.

MONZ, C. & LEUNG, Y-F. (2006). Meaningful measures: Developing indicators of visitor impact in the National Park Service Inventory and Monitoring Program. *The George Wright Forum*, 23(2): 17-27.

MOORE, S.A.; SMITH, A.J. & NEWSOME, D.N. (2003). Environmental performance reporting for natural area tourism: Contributions by visitor impact management frameworks and their indicators. *Journal of Sustainable Tourism*, 11(4): 348-375.

NATIONAL PARK SERVICE (2002). Obed Wild and Scenic River: Final climbing management plan. Wartburg, TE: US Department of the Interior, National Park Service, Obed Wild and Scenic River.

NELB, S. & SCHUSTER, R.M. (2007). Questioning the continuum: Specialization in rock climbing. *Proceedings of the 2007 Northeastern Recreation Research Symposium* (pp.204-209). Bolton Landing, NY: United States Department of Agriculture (USDA) Forest Service.

NESS, S.A. (2011). "Bouldering in Yosemite: Emergent signs of place and landscape." *American Anthropologist*, 113(1): 71-87. Hyperlink [http://onlinelibrary.wiley.com/doi/10.1111/j.1548-1433.2010.01307.x/pdf]. Retrieved on 15 July 2011.

NEWMAN, P.; MARION, J.L. & CAHILL, K. (2001). Integrating resource, social, and managerial indicators of quality into carrying capacity decision-making. *The George Wright Forum*, 18(3): 28-40.

NOY, S. (2010). *Rocklands bouldering*. Cape Town (SA): Scott Noy.

PARKIN, D. (n.d.). What is minimal impact? Project Nature-Ed Report. Brassall, Queensland (Australia): Project Nature-Ed.

PICKERING, C.M. & HILL, W. (2007). Impacts of recreation and tourism on plant biodiversity and vegetation in protected areas in Australia. *Journal of Environmental Management*, 85(4): 791-800.

POMFRET, G. (2006). Mountaineering adventure tourists: A conceptual framework for research. *Tourism Management*, 27: 113-123.

PORUCZNIK, J. (2009). Recreation site and trail impact assessment methods and procedures for bouldering areas in Little Cottonwood Canyon. MSc project report. Salt Lake City, UT: Department of Parks, Recreation and Tourism, University of Utah.

ROSS, P.M. (2006). Macrofaunal loss and microhabitat destruction: The impact of trampling in a temperate mangrove forest, NSW Australia. *Wetlands Ecology and Management*, 14: 167-184.

SACIN (2006). "Guide to Rocklands." Hyperlink [www.sacin.co.za]. Retrieved on 1 October 2006.

SCHOON, A.; SHROYER, M. & HUNZIKER, F. (2001). "An NGO's contribution to mountain conservation in South Africa." Hyperlink [http://www.mcsa.org.za/cent/06_archive/d_ conservation_a/reports/wi]. Retrieved on 3 July 2006.

SHROYER, M.E. & BLIGNAUT, P. (2001). "Mountain conservation in South Africa." Hyperlink [http://www.mcsa.org.za/cent/06_archive/d_conservation_a/reports/st]. Retrieved on 23 June 2006.

THE ACCESS FUND (2001). "Climbing management: A guide to climbing issues and the production of a climbing management plan." Boulder, CO: The Access Fund. Hyperlink [http://www. accessfund.org]. Retrieved on 2 June 2006.

THE ACCESS FUND (2006). "Bouldering: Understanding and managing climbing on small rock formations." Boulder, CO: The Access Fund. Hyperlink [http://www.accessfund.org]. Retrieved on 15 July 2011.

VASKE, J. & DONNELLY, M.P. (2002). Generalizing the encounter-norm-crowding relationship. *Leisure Sciences*, 24(3-4): 255-269.

VASKE, J.J. & DONNELLY, M.P. (2008). Visitor characteristics and beliefs about boulder open space and mountain parks. HDNRU Report. Fort Collins, CO: The Warner College of Natural Resources, Human Dimensions of Natural Resources, Colorado, CO: Colorado State University.

VASKE, J.J.; DONNELLY, M.P. & SHELBY, B. (1993). Establishing management standards: Selected examples of the normative approach. *Environmental Management*, 17(5): 629-643.

WESTERN CAPENATURE CONSERVATION BOARD (2002). Cederberg Nature Reserve: Integrated conservation development plan – vision, policies and operating guidelines. Cape Town (SA): Western CapeNature Conservation Board.

WURZ, S. & VAN DER MERWE, J.H. (2004). Gauging site sensitivity for sustainable archaeotourism in the Western Cape Province of South Africa. *South African Archaeological Bulletin*, 60(181): 10-19.

ZHONG, L.; DENG, J.; SONG, Z. & DING, P. (2011). Research on environmental impacts of tourism in China: Progress and prospect. *Journal of Environmental Management*, 92: 2972-2983.

APPENDIX A: BOULDERING MARKET APPEAL AND SENSITIVITY GAUGE (BMASG)

CRITERIA FOR INDIVIDUAL BOULDER PROBLEMS

A. MARKET APPEAL	***EXPERIENCE RATING (Score value)***			
	None (0)	**Low (1)**	**Medium (2)**	**High (3)**
ROCK QUALITY				
1. Grain cohesion	No cohesion, unfit for bouldering	Low cohesion, handholds, sandy or loose	Medium cohesion, some footholds sandy or loos	High cohesion, no sandy or loose holds
2. Grain size	Jagged and coarse (cause instant bleeding if climbed)	Coarse, but can be climbed, not skin-friendly	Some holds coarse, mostly fine, relatively skin-friendly	Fine and skin-friendly
FALL DANGER				
3. Result of potential fall (height)	Possible death	Bone-breaking	Light injury	Safe
4. Result of base gradient (steepness)	Possible death	Bone-breaking	Light injury	Safe
5. Result of base cover (hardness)	Unpaddable	>5 crash pads	3-5 crash pads	<3 crash pads
NATURE OF BOULDER PROBLEM				
6. Reputation value	None	Local	National	International
7. Aesthetics of line	No appeal	Low appeal	Medium appeal	High appeal (unique, clear or pure)
8. Grade (Font grade)	<6a	6a-6c+	7a-7c+	8a-8c+
9. Number of possible crux sequences of similar grade	>3	3	2	1
10. Degree of eliminate	Problem described and of fully eliminate nature	Holds off due to eliminate nature	Starting holds or top-out described	No eliminate
11. Ease of access	Inaccessible	Hard scramble, long walk-in	Moderate walk-in, easy scramble	Easy walk-in
12. Index of individual boulder problem attraction value	≤8	9-17	18-25	>25

B. DAMAGE SENSITIVITY	***VULNERABILITY/ROBUSTNESS RATING* (*Score value)***			
	None (0)	**Low (1)**	**Medium (2)**	**High (3)**
1. Archaeological artefacts present	Absent			Present (red-flag boulder and staging area)
PROBLEM DAMAGE				
2. Risk of human damage to structure of problem	None	One damage type	Two damage types	Full suite: chipping, gluing, holds breaking, polishing
3. Vulnerability to physical damage by nature	None	Low	Medium	High
4. Current level of damage	Pristine	Limited, reparable	Some reparable/irreparable	All irreparable
STAGING AREA DAMAGE				
5. Risk of erosion or disturbance of material	None	Low	Medium	High
6. Risk of vegetation damage	None	Low	Medium	High
7. Current level of damage	Original pristine condition	Limited, reparable	Some reparable, some irreparable	Irreparable
8. Index of individual boulder problem sensitivity	≤4	5-9	10-13	>13

CRITERIA FOR BOULDERING FIELDS OR SECTORS

A. MARKET APPEAL	***EXPERIENCE RATING* (*Score value)***			
	None (0)	**Low (1)**	**Medium (2)**	**High (3)**
INDEX VALUE: ATTRACTION OF INDIVIDUAL BOULDER PROBLEMS				
1. Number with high attraction index value	None	≤9	10-20	>20
2. Number with medium attraction index value	None	≤20	21-40	>40
BOULDER PROBLEM COMPONENT				
3. Number of problems	1- 20	21- 40	41-60	>60
4. Boulder problem variance	None	1-2 problem styles	3-6 problem styles	Full suite: roof, arête, face, slab, traverse, high-ball dyno
5. Range of boulder problem grades	1 Font number grade	2 Font number grades	All Font number grades	All Font number and letter grades

SPATIAL COMPONENT				
6. Distance of sector to next field	>20 km	20-10 km	9-1 km	<1 km
7. Average boulder size (height)	≤2m	2-3m	3-4m	>4m
8. Access to boulder field	Inaccessible or no bouldering allowed	Access with guides only	Some restrictions, permit system or number limitation	No access restrictions
9. Field problem dispersal or concentration	Widely dispersed	Some concentration	Medium concentration	High concentration
10. Average slope of field terrain (ease of movement)	>45°	31-45°	16-30°	≤15°
11. Index of field attraction value	≤7	8-15	16-23	>23
B. DAMAGE SENSITIVITY	***VULNERABILITY/ROBUSTNESS RATING (Score value)***			
	None (0)	**Low (1)**	**Medium (2)**	**High (3)**
ECOLOGICAL AND CULTURAL SENSITIVITY COMPONENT				
1. Level of formalisation and stabilisation of access paths	All paths formalised and stabilised with mini trail requirements (trail plan)	Shortcuts and redundant path systems present	Only kern system – no formalised and stabilised paths (no trail plan)	No formalised and stabilised trail development
2. Index of individual boulder problem sensitivity	<25% of problems with high sensitivity value	25-50% of problems with high sensitivity value	50-75% of problems with high sensitivity value	>75% of problems with high sensitivity value
3. Presence of red-flagged individual boulders	None	Located outside current boulder-fields development	Located in developed boulder-fields or sector	In staging area or boulders with problems
4. Vegetation sensitivity	No critically endangered or sensitive species	Sensitive species	Critically endangered species	Critically endangered and sensitive species

MANAGEMENT COMPONENT				
5. Management level	Formal management policy with enforcement and climbing-community support	Formal management policy without enforcement or climbing-community support	Informal management policy without enforcement & climbing-community support	No policy
6. Service provision	Full suite (guides, guide-books, ablution facilities)	Guidebooks or brochures and ablution facilities	Only guidebooks or ablution facilities	None
7. Access restriction	Access with guide, permit and limited numbers	Permit system with limited numbers	Permit system without limited numbers or limit not enforced	None
8. Structure of management	Climbing-organisation responsible for management; local representative	Private or public management with limited climbing-organisation involvement	Private or public management without climbing-organisation involvement	No responsible agency
9. Visitor-number monitoring	Full suite of formal monitoring (trail-use count, parking-lot inventories, permit system)	Formal monitoring measures	Informal or poor monitoring and recording	No monitoring
10. Involvement of climbing community	Climbing organisation as formal management agency	Formal partnership with management agency	Informal partnership with management agency	No involvement
11. Index of field sensitivity values	≤7	8-15	16-25	>25

CRITERIA FOR BOULDERING AREA

C. MARKET APPEAL	***EXPERIENCE RATING* (*Score value)***			
	None (0)	**Low (1)**	**Medium (2)**	**High (3)**
INDEX VALUE: FIELD OR SECTOR ATTRACTION				
1. Number of bouldering fields with high attraction index value	None	1	2-3	>3
2. Number of bouldering fields with medium attraction index value	None	≤3	3-10	>10

SPATIAL AREA COMPONENT				
3. Ease of access to area	>50 km to nearest town via secondary/ prov. gravel road	<50 km to nearest town via secondary/ prov. gravel road	<50 km to nearest town via tarred road	Within 100 km of metropolitan hub
4. Accommodation offered in area	None	Camping	Camping and guest house	Camping, guest house, cabins and backpackers
5. Potential for packaging with other tourism products	None	Associated cultural assets	Other adventure sports activities and/ or events	Other climbing products
6. Scenic ambience or beauty and sense of place	Degraded environment without scenic ambience or beauty and sense of place	High level of degradation detracts from scenic ambience or beauty and sense of place	Some degradation detracts from scenic ambience or beauty and sense of place	Outstanding scenic ambience or beauty, pristine natural setting and sense of place
BOULDERING COMPONENT				
7. Area's bouldering reputation	None	Local	National	International
8. Range of bouldering grades represented	One Font number grade	Two Font number grades	All Font number grades	All Font number and letter grades
9. Potential for new bouldering development in area	None	Projects or new variations of problems	New problems	New sectors or fields
10. Index of bouldering area attraction values	≤4	5-13	14-22	>22

D. DAMAGE SENSITIVITY	***VULNERABILITY/ROBUSTNESS RATING (Score value)***			
	None (0)	**Low (1)**	**Medium (2)**	**High (3)**
1. Climbing community representation	None	Local	National	International
2. Conservation status	None	National park or private conservation area	Wilderness area	World Heritage Site
3. Bouldering field sensitivity: area value	None	≤25% of fields with high sensitivity index value	26-50% of fields with high sensitivity index value	51-100% of fields with high sensitivity index value
4. Risk of new bouldering development	No new development possible or allowed	Development controlled by formal management, supported by climbing community	Development reported to management, controlled by informal management	No management control or reporting
5. Potential negative impact of high visitation on social fabric of local communities	None	Low	Medium	High
6. Level of cooperation between climbing community and management agency in area	Climbing organisation is formal management agency	Formal partnership	Informal partnership	None
7. Index of bouldering area sensitivity values	≤3	4-9	10-15	>15

Prof Johannes H VAN DER MERWE: Department of Geography and Environmental Studies, University of Stellenbosch, Private Bag X1, Matieland 7602. Republic of South Africa. Tel.: +27 (0)21 8083218 (w); Tel.: +27 (0)21 8871462 (h); Fax.: +27 (0)21 8083109. E-mail: jhvdm@sun.ac.za

(Subject Editor: Prof Wim Hollander)