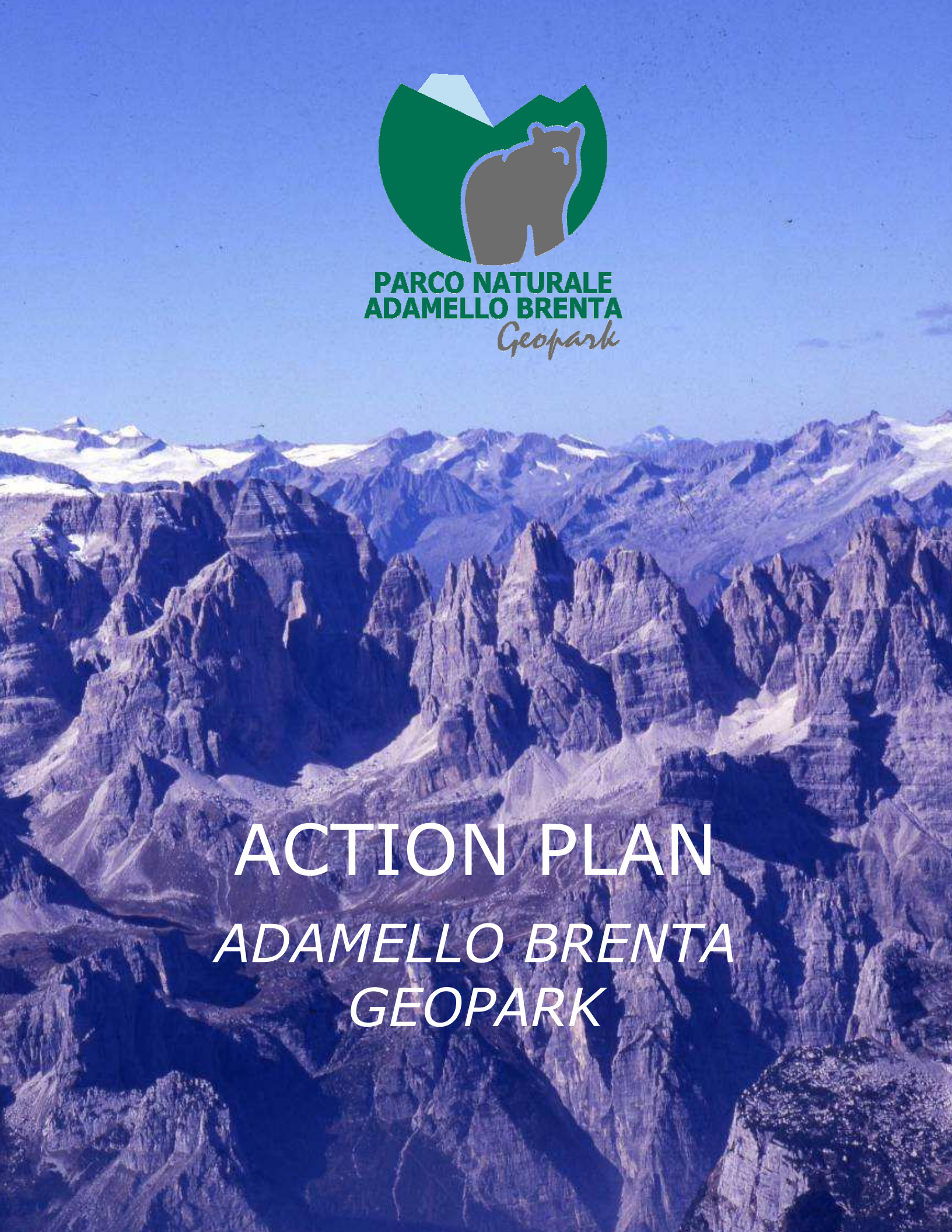

ACTION PLAN

ADAMELLO BRENTA GEOPARK

ANNEXES

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A THE GEOPARK AND THE NAUTURAL PARK

A.1 Geopark: conservation, promotion and protection

In relatively recent times it has become increasingly accepted that the geographical landscape as a whole, with its physical, biological, historical, architectural components, etc, is to be regarded as a valuable cultural heritage and the result of complex relationships, which must be known, protected and promoted.

Cultural heritage is normally referred to as documentary, historiographic, artistic, archaeological and architectural human works, but both biological and abiological "works of nature" are now increasingly considered to be part of our cultural heritage. The scientific community refers to them as "natural heritage" (Panizza, 1988; Barca and Di Gregorio, 1991).

The abiological natural heritage is subdivided into geological, geomorphological, geochemical, geo-historical, hydrological, mineralogical, paleontological, pedological, petrographic, sedimentological, speleological, stratigraphic, structural, tectonic etc. heritages. (Grandgirard 1999). All these different abiological heritages are universally known of as GEOSITE or GEOTOPE, abbreviated forms of "geological site" or "site of geological interest".

Geotopes represent important sites for studying the Earth, reconstructing its life and climate history (Grandgirard 1997); in addition they represent important sites for the ecological, economic and cultural value that they possess (Panizza and Piacente, 1993; Panizza 2001).

In recent years, the issue of awareness and appreciation of the geographical landscape, and more specifically of the geological heritage, has produced a scientific debate at national and international level which has provided extensive guidance on methods and criteria for the census, knowledge, conservation, promotion and protection of sites of geological interest.

UNESCO (United Nations Educational, Scientific and Cultural Organization) has been the first to recognise the importance of geological heritage protection. The definition of "natural heritage", which was chosen during the Convention on the Protection of World Cultural and Natural Heritage held in Paris on the 16th November 1972 (art.2), includes the following points:

- natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view;
- geological and physiographical formations;
- precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation;
- natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

In 1998 UNESCO launched the programme "Unesco Geopark", with the aim of promoting the value of geological heritage through, among other things, recreational tourism. This programme is based on an extensive collaboration between various international bodies: UNESCO Division of Earth Sciences, IUGS (International Union for Geological Sciences), WHC (World Heritage Centre) of UNESCO, MAB (Man and the Biosphere Programme) and IGCP (International Geoscience Programme, formerly the International Geological Correlation Programme). The programme aims to enhance

the value of those sites which represent fundamental evidence of the Earth's geological and evolutionary history and at the same time create opportunities for regional economic development.

The award of "Unesco Geopark" status is aimed at those territories encompassing one or more sites of geological importance in the broadest sense. These areas must establish a locally supported effective management system, taking into account not only the conservation of the geological heritage, but also enhancing scientific research and its dissemination, together with promoting recreational tourism and environmental education. These territories constitute UNESCO's GLOBAL GEOPARKS NETWORK (GGN), established in February 2004.

In 2004 UNESCO published general guidelines (UNESCO 2004, 2006) for Geoparks seeking UNESCO's assistance to join the GGN. The document states that Geoparks must have clearly defined boundaries and must be managed in accordance with national legislation (legal framework, finance, logistics support, geological heritage protection). It also points out that a Geopark includes a goal of geological heritage conservation and promotion of sustainable economic development. Geoparks' objectives are in agreement with Agenda 21, which is an action plan adopted at the World Earth Summit in Rio de Janeiro in 1992. It goes beyond the principles of the 1972 Convention concerning the Protection of the World cultural and natural heritage, highlighting the potential interactions between socio-economic development and conservation of natural heritage.

A Geological Heritage[1] can be defined as a number of non-renewable natural resources with scientific, cultural and educational (geological formations and structures, landscape morphology, paleontological and mineralogical deposits etc.) value, which facilitate the study and interpretation of the evolution of the Earth's geological history and the processes which shaped it. A Geological Heritage is one of mankind's common heritages; its maintenance, protection and conservation are essential, being it part of the broader concept of Natural and Cultural Heritage.

Taking into account these considerations, authorities must commit themselves to protect the Geological Heritage because its jeopardy and, even worse, its loss are to be considered as irreparable. Therefore, any form of development and soil occupation has to take into account the value and uniqueness of the heritage. In Europe, ProGEO (European Association for the Conservation of the Geological Heritage) works to preserve the rich geodiversity of the "Old Continent".

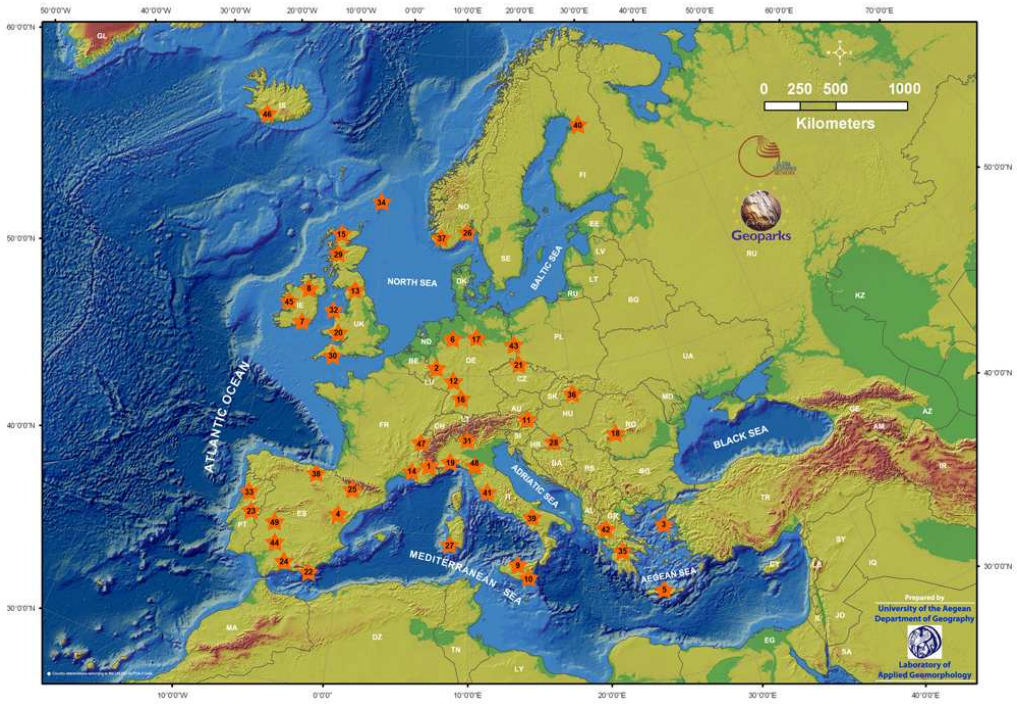
Many European countries have launched their own conservation and promotion of the geological heritage projects. The research activities operate:

- at a governmental level, with independent research bodies, which specialise in geological disciplines or are devoted to the protection of nature and the land (typical of British and Scandinavian countries);
- at a university level, with the involvement of various Earth Sciences and Natural Sciences Institutes;

[1] Decided in a significant document, approved in Digne (France) in 1991, at the end of the I° International Symposium for the protection of Geological Heritage: the Declaration of the Rights of the Memory of the Earth "

- at a non-governmental and scientific associations level, occasionally in partnership with museums and environmental education centres.

In 2004, a new European initiative joined the international network (GGN): the EUROPEAN GEOPARKS NETWORK (EGN), which was established in June 2000 within the European programme LEADER II C. The founder members of the network were: the Geological Reserve of Haute-Provence (France), the Natural History Museum of Lesvos Petrified Forest (Greece), the Geopark Gerolstein/Vulkaneifel (Germany) and the Maestrazgo Cultural Park (Spain). The main objectives of this network are the protection of geological heritage and the promotion of sustainable economic development (Zouros 2004). The activities of the Network are based on a charter signed on Lesvos (Greece) in June 2000. In April 2001, a cooperation agreement with the UNESCO Division of Earth Sciences (UNESCO/EGN 2001) was also signed, placing the Network under its patronage. The Network's headquarters is in Digne-les-Bains, in the Haute-Provence geological reserve.



Map of the 49 European Geoparks updated in September 2011

In order to properly protect the geotopes, it is important to educate the general public about their value and significance. The destruction of the geological and geomorphological heritage is, in fact, often due to ignorance. For the majority of people, geology and geomorphology are motionless "things" which are durable because they are "made of stone" and do not require any particular protection. It is therefore necessary to educate the public to a more dynamic concept of Earth and its surface and landscape, which are the result of ancient and complex processes. These processes are almost always unique and take place in a time scale difficult to comprehend in human time. This kind of education can only be achieved within certain territories, where geology and geomorphology are heritages so precious as to become the objects of educational and touristic development - the Geoparks.

According to the most accredited definition, a Geopark is a territory with clearly defined boundaries, large enough to ensure local economic development and characterised by the presence of several geological and geomorphological sites. A

Geopark may also include sites of ecological, archaeological, historical or other values (UNESCO 2004). Geoparks are therefore essential in order to promote, preserve and protect the geological heritage (UNESCO 2004, Jordan et al. 2004).

The European Geoparks Network (EGN) defines a number of characteristics for their Geoparks:

- There are no size limits for a Geopark. Nevertheless, it must be large enough to guarantee scientific interest and sustainable economic development. A Geopark cannot be created around a single object of interest, even immense objects (for example a mountain group or a spectacular cliff). On the other hand, a Geopark can be characterised by several geotopes clustered in a rather limited territory. On average, the European Geoparks vary from 15,000 to 200,000 hectares.
- A Geopark must be characterised by particular and rare geological and geomorphological heritages, with both scientific and educational interest. All the sites belonging to the heritage must be part of a network and share common programmes and activities;
- The heritage must promote long lasting local economic development, for example thorough geotourism;
- Local communities, together with the public administration and private institutions (economy, tourism) must be involved in the establishment of a Geopark. The bodies responsible for research and education must collaborate in order to achieve the correct management of the park. Based on this multidisciplinary approach, the Geopark should encourage trade and synergies between public authorities, private interests and the local population;
- The single sites of a Geopark must belong to a single network and be run by a suitable management body;
- A Geopark must be considered an experimental area, which promotes the development of innovative initiatives in the field of enhancement and protection of the geological and geomorphological heritage;
- A Geopark must have a clearly identified management structure;
- A Geopark must guarantee the protection of the sites which justify its existence;
- A Geopark must include sites of geological and geomorphological interest, which must be the object of a coordinated protection plan.

Besides ensuring environmental conservation, a Geopark must promote sustainable socio-economic development. For example, geotourism can create new job sectors and sources of income, especially through educational tourism or increasing local business. A Geopark must promote new scientific and educational opportunities and improve the conservation and protection of nature and the landscape.

From a touristic point of view, a Geopark may attract people to scarcely visited areas even during low seasons (spring and autumn). In particular, mountain regions are among the best candidates to become Geoparks as they already possess well established facilities (network of paths, cable cars, mountain huts, hotels, restaurants). Their single geotopes can be organised into a network of attractions. Under this framework, the geosites not only offer a scientific interest, but also economic opportunities, which will promote initiatives aimed at both the scientific conservation (protection of a non-reproducible heritage) of the sites and at ensuring sources of income. A Geopark plays a key role in the conservation of geological heritage, because it offers the opportunity to entirely appreciate the origin, formation processes and changes that shaped the present landscape.

Geological assets and the landscape can add value and interest to touristic areas. The development of these new attractions would create new jobs and increase

the region's economy, especially during low seasons. Moreover, educational and cultural interest, would attract new people to a territory normally only visited for sport and recreational activities. A network of information centres, cultural events, guided tours etc. would become a medium term source of income.

Such a structure would offer a "cultural tourist" several educational opportunities in various Earth Sciences Disciplines: courses, lectures, seminaries, educational material (useful to document the Geopark's geology and suitable to the layman). This would contribute to both the visitors' education and to the enhancement of the local heritage's value.

Geological elements are in this case transformed into "educational objects" and the Earth Sciences could become an unexpected novelty to experience outdoors during holidays. A Geopark could attract families, school groups and amateurs and could at the same time host scientists and research projects. Any tourist who enjoyed and appreciated a guided tour, is a potential future advocate for the protection of the geological heritage.

A Geopark creates a network of several geological and touristic attractions through educational (visitor centres, museums, mines open to public, naturalistic itineraries) and touristic (cable cars, hotels etc.) facilities. For this reason a Geopark needs a suitable reception centre, to which visitors and staff can refer. In order to properly use, value and protect the geological heritage, a clear development programme and professional management are essential. In addition, development and management plans should be shared with universities involved in research in the Geopark, which in turn can suggest actions and priorities related to the scientific importance of each geosite.

The study of the geological heritage is essential to the understanding of landscape changes and therefore it encourages a sense of responsibility towards nature: geotourism emphasises that responsibility. Therefore geotopes with a high educational value are the main resource of a Geopark.

A Geopark is the best solution for the conservation, promotion and protection of the geological heritage. A recent survey held in the Lesvos Petrified Forest Geopark (Zouros et al, 2008), showed that Geoparks are the most appropriate tool to increase awareness of the value of geological heritage and the proper administration of such structures guarantees the protection and the promotion of geosites, together with significant local development.

A.2 Why the Adamello Brenta Geopark

The Adamello Brenta Geopark territory represents an area of extraordinary geological-environmental interest and value, characterised by several spectacular geological features. There are numerous sites with high geological value, which when considered in their broadest sense, includes scientific interest, rare educational opportunities as well as cultural and historical importance. They represent the most significant heritage that the Geopark aims to promote and protect through the development of suitable and sustainable geotourism.

Since 1999, when the Geopark proposal was approved, the Park has shown its intention to promote scientific research in the fields of geology and geomorphology, emphasising the importance of taking a detailed census of all the geosites and geomorphosites, listing them as "natural monuments". The Park also aims to disclose the results of these studies. With this in mind, in 2005 the Park applied to become a member of the UNESCO European Global Network of National Geoparks and its candidature was discussed during the Management Annual Programme of 2006 and eventually approved by the Provincial Council with resolution n. 1729 on the 18th of August 2006.

The Park shares several EGN targets, such as:

- the geological heritage protection partnership;
- the promotion of local sustainable development, which is strongly related to the geological heritage (the Park's long term policy aimed at promoting sustainable tourism, has been recognised with the award of the 2006 European Charter for Sustainable Tourism);
- the promotion of geotourism initiatives, aimed at improving the environmental education and the development and dissemination of scientific research in various Earth Sciences disciplines.

The Park has already undertaken specific actions aimed at promoting the natural heritage (see cap. D.1); geological and geomorphological topics were in fact part of a special programme for sustainable tourism, called "Summer in the park".

The Geopark is characterised by a rich geodiversity, which represents an ideal open air natural laboratory. The value of the geological heritage can be taught through environmental education; this will raise awareness of the importance of protection and therefore conservation of such heritage for future generations.

Adamello Brenta Geopark (ABG) also represents a new form of tourism: geotourism, which raises the potential for the sustainable development of the local economy. Geotourism not only attracts the tourist interested in the environment and in Earth Sciences, but would also change the concept of mountain holidays, showing ~~to~~ the "ordinary" visitor new ways to fully appreciate and enjoy the territory.

The Adamello Brenta area has been frequently visited and studied since the 1800s and is still of great interest for geologists and geomorphologists. Many Italian and foreign universities and research organisations are currently active in the Geopark.

The widespread presence across the territory of suitable facilities that lend themselves to accept structured research units, as well as scientific education and dissemination of the highest quality, offers the possibility of "geotourism schools" at different levels, which would guarantee a constant enrichment and update of geological topics with their immediate and appropriate dissemination.

Geotourism could easily become a well-established activity, especially as it would benefit from the large network of paths which cross the entire Geopark. More than 900 km of well-maintained paths (the maintenance of which is performed by SAT (Tridentine Alpinists Society) and the Park's staff), allow the visitor to safely reach all the main sites of geological interest. Several mountain refuges and huts, normally used to offer shelter to climbers and hikers, could also be used to distribute educational material or offer theme events, guided tours etc.

ABG also contributes to the improvement of the existing relationship with local communities, authorities and businesses. They would deepen the strong link with the territory and its geology, which has always characterised and conditioned the lifestyle of the local population.

In addition, partnerships with the Tridentine Museum of Natural Sciences (TMNS), the Geological Survey of the Autonomous Province of Trento and other bodies like universities, could be consolidated, in order to continue the research and development of sites of geological and geomorphological interest.

Recognition as a Geopark, adds to the value of the territory, as it would benefit from worldwide recognition under the auspices of UNESCO.

In conclusion, belonging to the EGN, offers good opportunity for growth, with the possibility of learning from the experiences of other parks and sharing common European funded projects.

A.3 Geopark: an added value to the Natural Park

The Geopark's identity and its relationship with the Natural Park is a very important issue. According to the experience of other Natural Parks/Geoparks, it seems that there is a risk of duplication and, in some cases, that the Geopark's image could "disturb" or even overwhelm that of the Natural Park.

In the Adamello Brenta case, the Natural Park has already a well-established identity, with a twenty year history and well defined social, environmental and cultural roles. Nonetheless, it is important to avoid confusion and the mistake of considering two different organisations.

For this reason, the official name "Adamello Brenta Geopark" (ABG) must always be combined with the Adamello Brenta Natural Park (PNAB), possibly using "Natural Park Adamello Brenta Geopark", where Adamello Brenta is shared between the two. Only when necessary (documents, reports etc. exclusively related to the Geopark) the name ABG can be used on its own.

Great care must also be taken over graphical logos, the use of the PNAB logo must prevail over the EGN and GGN ones.

The new official logo for the Adamello Brenta Natural Park – Adamello Brenta Geopark

The name GEOPARK will therefore be added to the ADAMELLO BRENTA NATURAL PARK logo, using a different font. In this way the Geopark will be clearly visible, but plays a subordinate role to the main Natural Park.

It is important to avoid considering the Geopark as a sort of certification or award received by the Natural Park (like CETS (European Charter for Sustainable Tourism), ISO (International Organisation for Standardisation) or EMAS (Eco-Management and Audit Scheme)), as this would deprive the Geopark of its own identity. A Geopark *is an entity* in its own right.

Nevertheless, the Geopark status only lasts four years and, in the event of it being revoked, the logo will need to be modified.

This is a rather remote possibility, considering the effort required to obtain such a status and the commitment by the Geopark to work hard to maintain it. Even in this most unlikely event though, the name Geopark could still be used independently from EGN or GGN.

In this case, the Geopark status could be regarded as indefinite and inextricably linked to the Natural Park, Therefore the name Geopark could be kept in the logo.

A.4 Action plan: the Geopark within the Park's general plans

The status of Geopark as part of the European Geoparks Network (EGN) and of the Global UNESCO Geoparks Network (GGN) lasts four years. At the end of that period, a stringent inspection will verify if the park carried out all the actions initially planned.

For this reason, good planning is fundamental. It should focus both on a strong initial establishment of the Adamello Brenta Geopark's identity and subsequently on a programme of initiatives which would guarantee its growth and improvement, leading to the renewal of its status at the end of the four year term.

Such an Action Plan should not be thought of as only a four year limited programme, but also as a more complex operative plan, which could possibly include extra projects, founded within the EGN (INTERREG projects etc.).

In particular, the Action Plan should include the following goals:

- a good balance among the different objectives (protection, research, promotion/education);
- planning of possible actions to be taken in the different geosites and in the Geopark generally, together with a clear identification of their priorities;
- resource planning.

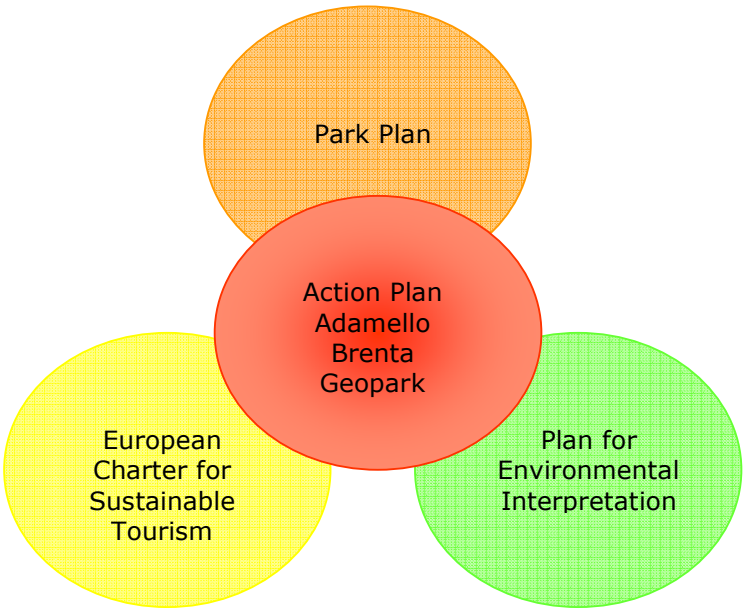
A long term, well defined, realistic and shared action plan, is an essential working tool for a multi-activity complex organisation such as a Park.

All the Geopark activities must be tightly linked to the broader programme for the Natural Park, which will help ensure a period of continuous promotion and growth for the Geopark.

In fact, the recent version of the Park Plan, officially included the Geopark's Action Plan into the Park's projects (art. 4.2.11 of the PdP (Park Plan) implementation rules).

In addition, being that the Adamello Brenta Geopark falls within the more general policy of sustainable tourism development adopted by CETS, the Action Plan will therefore take into account sustainable tourism strategies.

The Geopark Action Plan, will follow the PIA (Plan for Environmental Interpretation) guidelines, which gives general rules for the territory's promotion, visitors reception, information and environmental education.



In this way, the Action Plan grants the Geopark a key role in the general planning of the Park. The Geopark's most important projects will be included in the Annual Park Management Programme, together with other actions planned for different sectors (by the Environmental Management System for the environment; by the Wildlife Plan for wildlife, by the European Charter for Sustainable Tourism Strategy for tourism and by the Plan for Environmental Interpretation for environmental education and communication).

The Geopark Action Plan will be reviewed every four years, coinciding with the periodic review.

A.5 The Geopark as a network opportunity

The Adamello Brenta Natural Park has always been committed to building synergies with other organisations, institutions and protected areas, with the common aim of protecting the environment, following the principle of "act locally, think globally". The Park is active at a national level with the Federparchi (Italian Federation of Parks and Natural Reserves) and internationally as part of the Alpine Protected Areas Network (ALPARC), of which it is the leader in the big carnivores working group.

The Park's projects and aims are based on partnerships and cooperation with all organisations present in the territory. Moreover, it also creates networks and partnerships outside its own boundaries, following a global environmental policy. This is the approach which led to the decision to become the Adamello Brenta Geopark. As part of the European network, the Park would exchange experiences with other organisations with similar targets and values. New models for the protection and promotion of the geological heritage could therefore be created together and shared between different Geoparks. This would be the first step towards sharing management methods and joint projects, which could also benefit from EU funds.

An example of this "modus operandi" is the recent experience with CETS, which led to the establishment of a tourism development strategy in partnership with the Park's operators and Councils. The Park could act as promoter to encourage other parks, which share the same principles, to join CETS.

ABG could contribute to the establishment and promotion of an important Italian Geoparks Network (at present there are five parks: Beigua Geopark, Madonie Geopark, Rocca di Cerere Geopark, Sardinia Geomining Park), as part of the European National Geoparks Network. This national network would become a valuable reference and supporter for all future EGN candidates.

ABG is also committed to the World Heritage Site (WHS) "Dolomites" organisation, working on the establishment of a network between the dolomitic Parks candidates for UNESCO world natural heritage listing. The present Action Plan is in fact the first agreed implementation of the "Dolomites Heritage" Management Plan.

Finally, ABG will promote a new application to the EGN, which includes the ABG and the Adamello Regional Park areas, in order to share management strategies, enhance the value of the geological heritage and therefore take advantage of the exchange of experience and know-how.

A.6 The normative aspect: a tool for the promotion and protection of geosites

For the promotion and protection of geosites, the Geopark will refer to specific provincial rules such as the Provincial Urban Plan (PUP), the L.P. (Provincial Law) n. 37/1983 "Protection of the mineralogical, paleontological, palaeethnological, speleological and karst heritage" and on the Park Plan.

The sites of geological interest within the Park's protected areas, are subject to the Park Plan's rules approved by the Provincial Council with resolution n. 6266 of the 23th of July 1999, specifically art. 22, paragraph 4 states: "It is prohibited in these areas (geotopes and geomorphological sites) to change the contouring of the land or to add manmade objects which would change the existing view". Moreover, according to the above mentioned rule, removal of minerals and fossils throughout the Park is prohibited.

Sites with geological interest which are located in the ABG territory but outside the protected area, are protected by specific rules including:

- National Law n. 1497 of the 29/06/1939 which protects sites of geological interest.
- Provincial Law n. 37 of the 31/10/1983, as amended by the Provincial Law. n. 1 of the 04/01/1988, which aims to "*protect the mineralogical, paleontological, palaeethnological, speleological and karst heritage of the Autonomous Province of Trento*". Art.2 states: *Subject to the existing rules on mines, quarries and peatbogs, extraction and collection of minerals and fossils, even when scattered on the surface, is only allowed by those who possess an appropriate permit, except as otherwise stated in article n.10.* Art. 3 states: *Any mineral or fossil extracted or collected in the provincial territory cannot be traded, unless a specific permit is issued by the Provincial Council to public organisations or educational associations, which wish to acquire unique pieces or entire collections.*
- Provincial Urban Plan, implemented with resolution n. 2402 of the 27/11/2006, which identifies the "invariants", *namely those land features which characterise the environment and the territorial identity and which are stable or change extremely slowly. They require appropriate protection and promotion, in order to ensure a well-balanced and sustainable development of the territorial management under Art. 8*. They are the main geosites like *peaks, gorges, waterfalls, morphosculptures, marocche (ancient post-glacial landslides), karst areas, caves, glacial and periglacial landforms, areas with paleontological, mineralogical and stratigraphic interest*. The local Councils can modify and update the invariants' list.
- General Plan for the Use of Public Waters, approved by the D.P.R. (Presidential Decree) on the 15th of February 2006, which regulates all aspects of water management including its quality, quantity and safety.

Most of the area is subject to specific European Community guidelines, with regards to the protection of natural resources. Some 81% of the Geopark territory is characterised by 25 Sites of Community Importance (SIC) according to "Directive 92/43CEE on Habitat conservation" and 4 Special Protected Areas (ZPS) according to "Directive 79/409/CEE on wild birds conservation".

The laws and regulations of the Autonomous Province of Trento which protect assets of geological, geomorphological, hydrological, paleontological and mineralogical interest, should be able to guarantee suitable protection for these sites.

Nevertheless, the Park, in agreement with the regional Councils, wishes to improve the existing protection plans, focussing them on specific geological-geomorphological aspects and enhancement projects as well. In fact, in order to

properly protect geosites or the environment in general, it is important to promote the value of these sites through education.

Following the recognition as a European and Global UNESCO Geopark, the regional Councils are committed, as stated in the letter of support addressed to the Park, to report as invariants in the New Provincial Urban Plan all those sites of geological and geomorphological interest, which are indicated in the present dossier and which have been identified outside the protected area. The Councils will then have the opportunity to protect these sites, following the Province and PUP guidelines.

The whole Geopark territory is subject to the protection measures indicated in the New Provincial Urban Plan, which was approved by Provincial Law n.5 on the 27th of May 2008, published in the Regional Official Gazette on the 10th of June 2008, n. 4, supplement n. 2. PUP, through its principle of reasoned use of the land resources (sustainability), is the main instrument for managing and protecting the environmental resources as well as developing the landscape as a fundamental element of identity and territorial quality.

PUP is composed of:

- Illustrative report (annex A);
- Implementation rules (annex B);
- Cartography (structural framework, annex C);
- List of invariants (annex D);
- Guidelines for producing strategy plans for the territory and for the evaluation of those plans (annex E);
- Support material for territorial planning (annex F);

This explains the opportunities offered by the provincial territorial plan, in terms of promotion and protection of the Geopark's geosites.

The Provincial Urban Plan includes the main physical structures of the provincial territory, namely those features which are the result of geological evolution and which characterise the geomorphology and the changing conditions. Among permanent features, which constitute the real physical invariants of the territory, the plan indicates the large tectonic landforms (morpho sculptures, karst and glacial landforms, sites of paleontological, mineralogical and stratigraphic interest), focussing on their promotion and protection.

Invariants are therefore "those land features of which distinctive stable or slowly changing characteristics must be protected". The following widespread features are closely associated with the territory and can be considered as assets, namely:

- **principal geological and morphological elements** (morpho sculptures, karst and glacial landforms, sites of paleontological, mineralogical and stratigraphic interest) included in the PUP list and which must be promoted and protected in accordance with the specific law;
- the **dolomitic heritage**, included in the annex D;
- the **hydrographic network**, which consists of surface and underground water systems (selected lakes, rivers and streams, wells and springs) and glaciers. This network is regulated by specific rules that PUP must refer to.
- **state forests** and **woods of value**, identified by forestry and mountain plans and special natural areas (natural parks, areas of the European network "Nature2000" and natural reserves), which must be protected and promoted according to the specific regulations;
- **agricultural areas of value**, identified by PUP on the basis of cultural and scenic value and which must be protected with the aim of improving productivity and the attractiveness of the territory;

- **Representative scenery** (environmental, archeological, architectural, historical and artistic assets) as elements which identify localities and which must be known and studied. Refer to specific regulations or institutional initiatives for the criteria of their identification and protection.

From a provincial planning system flexibility perspective, the PUP structural framework is based on studies and surveys carried out by the Province and local communities.

The most representative geomorphological features of the territory (morpho sculptures, karst and glacial landforms, sites of paleontological, mineralogical and stratigraphic interest), are described in PUP within the structural framework (annex C) and are also part of the invariants list (annex D).

Assessment of the value of specific features and development of the territory must be carried out in accordance with the Provincial Law for the protection of the mineralogical, paleontological, speleological and karst heritage (P.L. 37/1983).

The promotion and protection of geological and geomorphological invariants contribute to a deeper understanding of the territory. Therefore, local and general planning schemes must consider the following elements:

- Identification and census of the landforms;
- Area boundaries;
- Geological characterisation (speleo-hydrographic in case of caves and karst areas)
- Protection and promotion plan according to the P.L. 37/1983.

Promotion and protection action – operative tools

Karst landforms

The Provincial Law of the 31st October 1983, n. 37, on "Protection of the mineralogical, paleontological, palaeethnological, speleological and karst heritage", takes into account in art. 14/3 the establishment, within the Geological Survey, of the Cadastre of caves and karst areas, in which topographic data and provisions about the possible use, conservation and protection of these features must be included.

The Provincial Council, under resolution n. 594 of the 14th March 2008, established within the Geological Survey, the Provincial Cadastre of natural caves present in the Autonomous Province of Trento. The Geological Survey is responsible for updating the data, the adoption of appropriate related documents and for arranging agreements with holders of relevant data. It is also responsible for making the Cadastre data public and easily accessible using modern methods of communications (internet). The same resolution also defines the criteria for updating the cave Cadastre.

The Geopark, in collaboration with the Geological Survey, will update the Cadastre's section concerning caves and karst areas present in the Geopark's territory.

Glacial and periglacial landforms, sites with geological value

According to Art. 8 of the PUP Implementation Rules, those land features which characterise the environment and the territorial identity and are stable or change extremely slowly are considered to be invariants. They require protection and promotion, to ensure the balanced and sustainable development of land management plan initiatives.

More specifically, invariants are the main geological and geomorphological features included in annex D of the PUP, examples of these are morpho sculptures, karst and glacial landforms, sites of paleontological, mineralogical and stratigraphic interest, which must be protected and promoted according to the specific regulations following the guidelines of the illustrative report (PUP annex A).

The above mentioned report identifies local and general land management plans as reference documents for detailed studies (field studies) of the different land features.

The study must include:

- Identification and census of the landforms;
- Area boundaries;
- Geological characterisation (speleo-hydrographic in case of caves and karst areas)
- Protection and promotion plan according to the P.L. 37/1983.

The Geopark will use the PUP guidelines to update the list of invariants (glacial and periglacial landforms and sites of geological interest) present on its territory.

B THE PARK STRATEGY

B.1 Operative structure

This chapter explains the Geopark's interpretation (PIA guidelines), scientific research and protection strategies required to efficiently implement their planned projects.

The size and complexity of the activities, which will be described in the following paragraphs, already highlight the need to make adjustments to the present operative structure of the Park.

Until now, all the activities linked to the Geopark, from the initial application to the preparation of this action plan, have been achieved thanks to the collaboration of staff "borrowed" from the communication sector. This made it difficult to coordinate the activities between the Geopark and the local authorities.

The magnitude and significance of the activities related to the Geopark are of extreme importance to the Park; it is therefore necessary to provide the Geopark with a functional operative structure, which will be organised into three main levels.

1. First, a geologist will work in the technical office of the Geopark; his/her main duty will be the promotion and implementation of the Action Plan. The geologist will constantly monitor the plan's development and, if required, will coordinate, collaborate on, or implement those planned activities.

In addition to this, the geologist will also be responsible for environmental education and interpretation activities, which will indirectly verify the implementation of the planned actions.

The geologist is also the primary contact person, who will manage the correspondence between Geoparks, attend the two annual meetings and will take an active role in European projects that involve the Geoparks Network.

Finally, the geologist will also perform geological assessments in support of internal public works. This will simplify and reduce the costs of technical aspects of the Parks' administrative activities.

2. The large volume of planned environmental analysis and educational activities must also be taken into account. In order to guarantee a high level of competence, a partnership with the Tridentine Museum of Natural Sciences, is desirable. The Museum is able to offer, especially in summer, highly specialised staff, as demonstrated in 2008, with the initiative "Tovel Special".

This should be a flexible partnership that plans, executes and disseminates geotourism activities.

The Museum will provide geological iconographic material for the Park's archive. Special pieces could also be borrowed from the Museum.

3. Finally, the establishment of a permanent work group, the Geopark Committee, is extremely useful. Members should come from the Tridentine Museum of Natural Sciences, the Geological Survey and the Park. The Committee will suggest new strategies, update the Action Plan, deal with educational activities, collaborate on common projects, coordinate scientific research and plan specialised activities.

Normally there would be no committee costs, unless special tasks are requested.

B.2 Strategic priorities

B.2.1 Interpretation

One of the main goals of the Geopark is the promotion of its geological heritage. The aim is to raise awareness of the existence and importance of the geological assets and of the key role that geology can assume in the economic and social development of the area.

The promotion of such heritage, based on adequate communication and cultural activities, would also be a means of protecting this heritage.

The action plan for the next four years, which is based on the Plan for Environmental Interpretation (PIA), is described in chapter D.

All necessary steps need to be taken to ensure easy access to all facilities, with particular attention being paid to disabled and elderly people, and also young children, based on PIA guidelines.

SUPPORTIVE ACTIONS

- **Staff training**

Human resources play a key role in achieving the EGN goals. All levels of the workforce, from reception staff to those involved in educating the public, require specific training. It is essential to find motivated and qualified staff that may be properly trained with additional qualifications and refresher courses being offered, as indicated by the PIA.

- **Documentation and informative tools**

In order to plan and develop new projects and initiatives consistent with AP guidelines, the Geopark's management operational structure must rely on qualified and up to date data.

This requires the creation of an information system with easy access to the Geopark's database.

Such a system would include information about every individual geosite, for example using assessment cards of the geomorphosite project, which contain descriptions, cartographic extracts (chorography, geology, geomorphology, vulnerability, risk and danger), iconography and references (scientific, general).

This is an essential tool for territorial planning and a primary data source for the Geopark's development projects (promotion, protection, etc.).

External users can directly access the database from the internet, through appropriate access filters.

- **Assessments and questionnaires**

Questionnaires are useful tools to assess what the public would like to see developed in the areas indicated in the Action Plan.

In this regard, the positive experience in planning and implementing the natural trail "Vallesinella Springs" in the Park can be used as a model.

FACILITIES

- **Park centres and Geopark corner**

The EGN assessment committee indicated the necessity for the Geopark to establish a visitor centre focussed on geological topics. The Natural Park is already equipped with seven themed (flora, fauna, territory etc.) centres, but geology is only marginally represented.

The "Geopark Visitor Centre" must act as reception and information centre, with facilities also suitable for educational and training events. The centre should also provide areas for temporary events (exhibitions, displays, shows etc.) and be the focal point of the park, where visitors can be stimulated to discover and enjoy geology.

It will be useful to create a network between the Geopark Visitor Centre and other Park centres. Where possible, areas, either indoors or outdoors, which address specific geological themes in the park, should be identified.

In addition, according to the EGN guidelines, every centre must dedicate a specific area to both the European and Global UNESCO Geopark Networks (Geopark Corner), in order to promote the two networks to the public. This space can also be used for multimedia presentations.

- **Geotourism trails**

The trails (walking, mountain biking, horse riding, skiing etc.) are a Geopark strong point. They allow the territory to be safely explored in search of geological and cultural sites. The geosites could be the focal point of a particular trail. According to the tourist mobility management plan, the geotrails must use existing road networks (ordinary traffic, forestry traffic and paths).

Trails can be graded in terms of danger, accessibility, capacity (number of visitors to certain areas) etc. Existing nature and hiking trails (Dolomites Brenta Trek, V. Marchetti Glaciological Path, Vallesinella Springs Trail, Tovel Valley Theme Trails etc.) can be enhanced with geological information and also integrated into trails which encompass sites of geological interest.

Data from the geosite Cadastre should be used to plan geotourism trails, guiding the visitors to suitable areas of geological interest.

According to PIA guidelines, when new trails are created, the use of information panels must be limited. Therefore, any new project or updates to existing ones, must meet PIA regulations.

- **"Refuges and their surroundings"**

Regardless of the presence of geosites, the areas surrounding the Geopark refuges should be described. The descriptions must be brief and mainly iconographic, with different types of information material (brochures, panels next to the hut etc.). The refuge's staff should be knowledgeable of the surrounding areas and a primary source for visitor information.

- **"Quarries and their surroundings" – value of the historical and cultural aspects of quarrying activities**

Short specific itineraries will contribute to the knowledge of the local lithology and to the historical and cultural aspects of quarrying activities present in the Geopark. Informative material will be provided (brochures, documentaries etc.) and, if possible, small museums can be organised next to relevant demo-ethno-anthropological geosites.

COMMUNICATION

- **Cultural Mediation and Advertisement**

Communication is crucial for promoting and advertising the Geopark, as well as for raising awareness of the geological heritage and its role in economic and social development. It is therefore fundamental to plan appropriate communication and cultural mediation strategies, in order to involve local residents and social and economic operators.

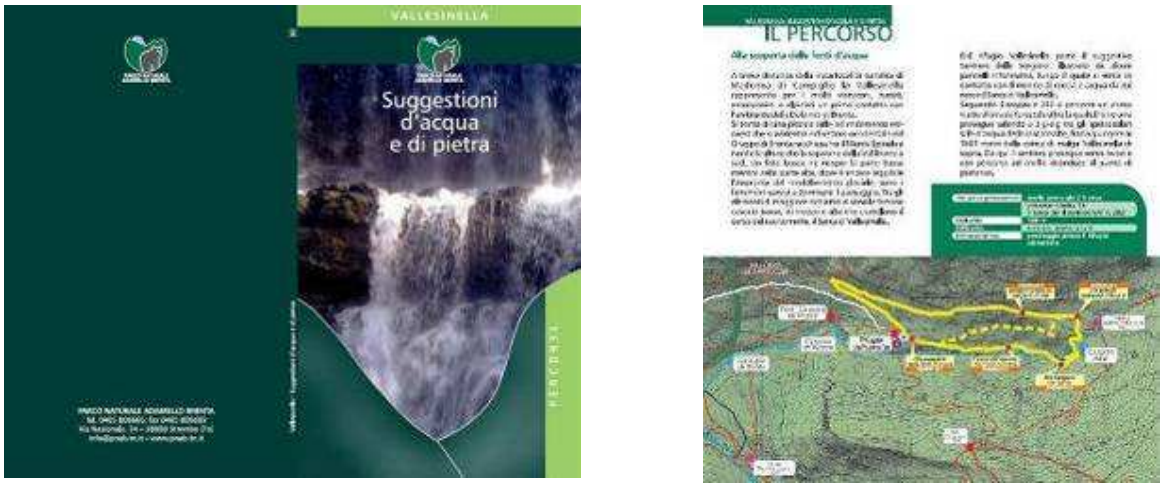
A more targeted approach, focussed on natural and leisure aspects, must be planned for the Geopark visitors (hikers, tourists, alpinists etc.): Earth Sciences publications and merchandising.

In line with PIA guidelines, all published material must be written in Italian and English. In addition to publications, EGN also propose the use of different media like audioguides.

- **Publications**

New publications will belong to the Park's series "Guides" or "Itineraries", which generally include both geological and biological themes. In case of geological monographs, the topic must be clear from the title and not from specific logos or a different type of series. The format of geological books should be the same as for the guides, with the addition of suitably scaled foldable maps or supplements.

More specifically, abridged educational geological and geomorphological publications of well-defined areas (Vallesinella Trail, Genova Valley Trails, Alpe Nana Trail etc.) will be issued. The aim of these guides is to publicise, in addition to the natural and cultural aspects, the exceptional geodiversity of the Adamello Brenta Geopark, and the implications they have on human activity.



Example of a geotourism guide (Vallesinella Springs)

- **Brochure**

A brochure is required that explains how the Geoparks function on both European and global levels and also illustrate in a simple and clear way the characteristics of the Adamello Brenta Geopark and its geology.

- **Geosites and geotourism cartography**

Geotourism cartography is an efficient communication tool, especially for the general public who is still not aware of this topic. Hopefully the presence of geomorphosites and geosites will soon be documented on traditional tourist and hiking maps, next to the usual historical, architectural, biological etc. information.

Representing a thematic feature on a map is the most effective and concise way to disseminate information about it. Graphical information is, in fact, much more effective than a written document, which instead provides a more detailed, but less immediate, description.

- **Filmography**

The first step the Geopark will take in this field, is to unearth published material (for example: Aladdin and Bus della Spia Caves), in order to acquire and enhance it.

In addition to this, the Geopark has recently purchased the RTE software, which will allow it to produce a 3D audio visual documentary on the Geopark's geology and its relationship with man (ancient caves and mines, glass factories etc.). The documentary will be used in the Geopark Visitor Centre and on the Geopark's website.

The production of new films has not yet been planned, mainly due to costs and to the complexity of the work.

- **Website**

As already stated, the Geopark is part of the Adamello Brenta Natural Park; therefore some webpages within the Natural Park's website www.pnab.it will be dedicated to the Geopark, under the section "Who we are".

The site will include the online version of published guides (pdf), itineraries and maps, information on the Geopark's territory through interactive maps, details about the geosites, GPS data for trails and a 3D (RTE) virtual trip inside the Geopark.

- **Logos and graphics**

As already mentioned in chapter A.3, specific graphic solutions have been designed that integrate the Geopark into the logos and graphics of the Natural Park, without disturbing the established identity of the Natural Park.

The selected graphic design (see cap. D.2 action 3.25) appears to respect this constraint.

A special logo has been designed for merchandising. It highlights the "geoproduct" character and it will be used together with the general logo.

- **Merchandising**

EGN suggested the creation of a line of geoproducts, as a way to improve the official recognition of the Geopark. The products must represent the geological heritage and will be sold, together with other products, in the Information and Visitors Centres of the Park.

- **Mascot**

A new Geopark mascot has been designed with the requirement to avoid any similarity with the Natural Park official mascot "Oswald the Bear". The Geopark mascot should only be used to convey complicated geological concepts to children, in a suitable language and in a simple and attractive way.

With this aim "Tonalì" has been created. The mascot represents a tonalite pebble. The rock has been chosen as the most representative of the park's lithologies and for ease of realisation.

The ABG mascot Tonalì.

ACTIVITIES

- **Educational area**

The Geopark presents an extraordinary opportunity to educate people to respect and protect the environment, to raise awareness of the historical and cultural values of local traditions and to implement sustainable development policies. These values contribute to the improvement in well-being and quality of life.

Schools are among the main groups to spread this culture and the Geopark has the potential to become a permanent learning centre for all levels of environmental education.

Schools

According to EGN directives, the Geopark must develop its existing learning activities to include Earth Sciences topics, and plan new projects.

New projects on geological topics will be planned for those Institutes in partnership with the Geopark. The topics are in agreement with the PIA's vertical curriculum for environmental education, which includes specific programmes for different school levels, from primary to secondary first grade.

Learning facilities also include the use of laboratories, excursions and lessons with geologists. Teaching material will be produced and will be accompanied by the Geopark mascot.

Long-term training

In order to raise awareness of different Earth Sciences topics, training courses for school teachers at all levels will be organised. In addition, special seminaries related to the Geopark and to the planning of educational projects will be held.

Geology training courses will also be developed for government bodies and private organisations operating in the environmental field.

Higher education

The Geopark's territory has long been the subject of scientific studies and research and it therefore represents an open-air laboratory available to researchers, scientific teams and universities. In particular, research in the Adamello-Presanella and Brenta Dolomites, mainly covered topics such as glacialism, geomorphology, karst, stratigraphy and petrology of the crystalline.

For this reason, the Geopark has all the potential to become a permanent centre for higher education on such topics. The Geopark can act as centre of logistic support, a source of expertise etc.

Therefore it is essential to create a network of contacts with universities or research centres which normally operate in the park. The Geopark could become a branch of those research organisations, offering the use of the Park's three guesthouses. The partnership will also have a long term positive impact on the territory.

- **Geotourism**

Visitors (hikers, tourists, alpinists etc.) are a very important aspect of promoting the Geopark's natural and recreational facilities. It is important to offer targeted touristic products, focussed on the use and enhancement of the geological heritage, as suggested by the Geopark Action Plan. It is also useful to develop partnerships with local businesses, local authorities and the Park itself, in agreement with the principles of the European Charter for Sustainable Tourism and the Quality Park certification.

A crucial aspect is to assess the Geotourist's satisfaction. Assessment methodologies concerning the Geopark's activities and products will be carefully planned.

- **Awareness and involvement of residents**

One of the Geoparks' strategic targets is to make the geological-environmental heritage the source of local socio-economic development. This can be achieved through a properly planned awareness programme aimed at the local population, administration and local government and businesses.

Being part of the European Charter for Sustainable Tourism, the Natural Park already operates with the same philosophy. Hence the Geopark will join an established programme, extending the opportunity to apply the Charter's principles.

Residents must therefore be properly informed of the significance and potential of the Geopark and play an active role in the growth and development of the project. Initially, several meetings and public debates – as part of the European Charter for Sustainable Tourism forum – will be planned, in order to share and raise awareness of the Geopark project with as many people as possible.

In the meantime, local government will be encouraged to join the protection and promotion of the geological heritage, following the Action Plan guidelines.

Economic and cultural operators will be made aware of the economic potential of the Geopark.

- **Geoparks week, meetings, workshops and conferences**

Membership of the EGN involves constant correspondences, participation in two annual meetings (spring and autumn) by the official ABG representatives (Claudio Ferrari e Violette Masè), organisation and attendance of workshops and thematic congresses on Earth Sciences and their protection and promotion.

B.2.2 Scientific research

The Geopark, together with the Autonomous Province of Trento (APT) Geological Survey and the Tridentine Museum of Natural Sciences, will survey and coordinate all the on-going research projects, which can be carried out either by the Park itself or by other organisations. The main research projects are:

a. Geological and geomorphological cartography.
The majority of the Geopark's territory is covered by the new 1:50.000 geological cartography produced by the CARG-PAT Project. Some areas though, are either still uncharted or require further investigation, especially geomorphological features. In order to integrate the existing cartographic survey, it is necessary to carry out a complete and detailed survey of these areas.

b. Geomorphological risk assessment along natural trails, near to geosites and guided tour stops.
Some morphological elements, which in normal situations would not be dangerous, could become a risk in different seasons or in rapidly changing weather conditions, especially when a large number of tourists visit the area. A detailed survey on geological risk along the natural trails would be of great importance in order to properly plan and manage the flow of visitors.

c. Research and projects on the hydrology of karst areas and caves.
The Brenta Group is one of the main karst areas in the Province of Trento and in recent times its karst aquifers have been extensively studied and monitored. Karst areas and caves which belong to the Geosites list (i.e. XII Apostoli depression, Pozza Tramontana pool, Collalto Cave etc.) have been identified in the Brenta Dolomites.
The Provincial Cadastre of natural caves present in the Autonomous Province of Trento, was produced within the Geological Survey by the Provincial Council, under resolution n. 594 of the 14th of March 2008. In order to supplement and update the Cadastre data to allow improved protection and value for these geological features, each of these areas could be studied, with particular attention to their hydrological characteristics.

d. Permafrost monitoring – PERMANET project
The alpine permafrost is defined as any land that remains below 0°C for at least two consecutive years. The Permanent project consists of long term monitoring of some areas within the Geopark. The main aim is to study in detail the thermal conditions at the soil surface in relation to the presence of permafrost and to consider the climatic and environmental conditions (temperature, exposure, presence and evolution of the snow cap).

e. Stratigraphic, paleontological and mineralogical research.
Some of the Geopark sites are already well known for their mineralogical and paleontological interest, but other less known areas deserve to be studied and promoted, as part of the geological heritage. Therefore, a research programme aimed at the identification of new sites and at the study of existing ones will be planned.

f. Research project on volume reduction in glaciers from the LIA (Little Ice Age) to the present.

Glaciers are natural systems which retain information about the environment and climatic evolution of a particular area. Their past history can shed light on current and future dynamic mechanisms. This research aims to assess ice volume loss and its related water loss. The study will be carried out by comparing past and present volumes of the Geopark's glaciers, based on field evidence, historic cartography, aerial photos etc.

g. Research on fossil earthquakes in the Adamello-Presanella Group.

This is an existing project, coordinated by the University of Padua in partnership with the Tridentine Museum of Natural Sciences. The study is part of an international programme aimed at analysing the mechanics of earthquakes based on the study of exhumed faults. The study will have an important impact on the seismic monitoring programme carried out by the Geological Survey of the Autonomous Province of Trento in the past years. The programme is focussed on the mechanisms which control recent and present events.

Seismogenic faults which 30 million years ago were active at a depth of about 10-13 km, today outcrop in the Adamello-Presanella Group. These exceptional outcrops have no equivalents in geological literature and present a unique opportunity to study the processes that occurred on a fault plane during an earthquake. The main part of earthquakes normally occur at a depth of 10-15 km and the information on the physical parameters of a seismogenic source are largely derived from indirect observations, mainly based on seismic data processing or remote monitoring. The outcrops of the Adamello-Presanella faults therefore represent a precious open-air laboratory.

h. Geodiversity/Biodiversity

Projects to be defined.

B.2.3 Methods for the protection of geosites

The geological heritage of the Adamello Brenta Geopark is fundamentally intact and is characterised by a rather low vulnerability level. This is mainly due to the nature and location of the geosites. Some of the sites though, if neglected, could in time be damaged.

Based on potential natural and anthropogenic degradation, the Geopark's geosites have been classified into four categories. Suitable protection procedures and fencing criteria are indicated for every category.

It is therefore necessary to identify the exact location of all Geosites. In the case of large sites, they must be identified and properly marked on specialised maps. The Park's cartography and database will be updated, following a procedure still to be defined.

Fencing the geosites would be very complex and difficult to carry out, because many geosites are formed by several elements, forms and processes and can be very large. Hence it would be reasonable to install information signs at the access points and to only fence particular spots.

One of the main aims of the Geopark is to promote and protect the geological heritage and for this reason it is necessary to define a procedure for the formal establishment of new geosites.

- **Glacial and periglacial landforms**

This category includes all sites linked to glacial and periglacial processes.

The main natural vulnerability factor for this category is climate change, which causes the progressive contraction of the glaciers and morphological changes of rock glaciers. Anthropological threats are instead ice surface trampling and displacement of snow masses.

The trampling problem can be solved by the use of selected, well defined and marked trails. Instead, displacing snow masses must be avoided, especially in cases of research on limited snow areas.

- **karst landforms**

All those geological features representing karst processes and forms belong to this category. These sites were formed by the same natural processes which can be seen today and no other processes have been identified that jeopardise them.

Instead, anthropological activity, either permanent, occasional or accidental, is the main risk factor for these geological assets. In particular, karst systems can be seriously damaged by removal of concretions, disturbance of the hypogean fauna, modification of the microclimate and pollution.

Easily accessible caves (i.e. Bus della Spia and Silvia Caves) can simply be fenced and access can be limited to guided tours only. There are caves of special interest though, like the Bus della Spia and Silvia Caves, which host hypogean fauna colonies, or the Castelletto di Mezzo Cave, with its fossilised ice deposits. Before opening such caves to the public, the impact of human presence on their fragile environment must be assessed.

Another serious risk factor for karst areas is solid and liquid pollution, which could also affect the quality of springs used as drinking water. The risk is rather remote, due to the high altitude of the karst areas and to the limited presence of anthropological structures (hotels-shelters-refuges etc.), but it still has to be taken into account. Hence, karst areas and hydrological basins must be properly identified and studied.

- **Sites of geological value**

This category includes all the sites with geological-stratigraphic, sedimentological, paleogeographic, paleontological and geomorphological features and which do not fall into the two previously mentioned categories.

Natural causes that can modify or damage these sites are limited to possible morphoclimatic changes which could lead to the disappearance of certain geomorphological assets (e.g. waterfalls).

Instead, a more serious risk factor is represented by anthropological activities: vandalism, removal of samples, trampling outside tracks, manufactured products, infrastructures and earthworks.

Vandalism and sample removal are rather remote risks. Even the Geopark fossil sites, potentially vulnerable to this kind of problem, are not considered to be at risk.

As for other categories, outside track trampling can be avoided by the use of well-defined and marked trails, together with a proper public awareness campaign.

Particular attention should be paid to planned manufactured articles, infrastructures or earthworks, as damage to geological forms or deposits must be prevented. All these activities are regulated by the Action Plan within the Park's protected area, while outside, the rules specified in the A.5 paragraph apply.

- **Demo-ethno-anthropological sites**

This last category includes those sites which play a key role in the socio-economic development of a particular area of the Geopark. One of the risk factors is the natural deterioration of old infrastructures (e.g. old quarries, mines, glass factories, furnaces etc.); there needs to be a planned activity of restoration and maintenance. From a more general point of view, potential damage can be caused by modifying and/or building new structures. In this case, care must be taken when introducing new features in the site.

C ASSESSMENT OF GEOSITES

C.1 Critical analysis of previous studies

Any geological natural element, whether unique or of particular interest, can be considered a geotope. According to Grandigirard (1997), geotopes are "*portions of the geosphere which present particular features useful in understanding the evolution of the Earth*".

In addition to this definition, which can be applied to many natural phenomena, the term Geomorphosite can also be used. Geomorphosites are "*any landscape form with peculiar and significant characteristics that can be considered part of the cultural heritage (sensu lato) of a territory*" (Panizza 2001). In addition to the well-known terms "geosite" and "geomorphosite", other definitions can also be found in literature: "geomorphological activity" (Panizza and Piacente 1993), "geomorphological asset" (Carton et al. 1994), "Geomorphological site" (Hooke 1994), "geomorphological geotope" (Grandgirard 1997) or "site of geomorphological interest" (Rivas et al. 1997).

The increasing interest in Environmental Heritage in recent years, stressed the need to possess the appropriate tools to evaluate, protect and manage such heritage and to accurately identify and select those assets. It is only by recognising the real value and significance of any single asset that will make it possible to develop a management policy (Scarelli and Poli, 1999).

Several methods for quantitative assessment of the geological heritage have been suggested in literature. The earliest ones date back to 1970 and generally come from English speaking countries, mainly the United States. Some assessment procedures formulated by Linton (1968), Leopold (1969) and Ammende (1968) are noteworthy. They suggest morphometric measurement methods for those elements which represent the scenic quality of the landscape.

In the last two decades, more quantitative assessment methods have been proposed, with the aim of selecting and classifying, utilising a rating system, the non-biological environmental assets. Initially, the suggested classification criteria followed land management planning programmes or the environmental impact assessment (VIA) guidelines, with the aim of defining priorities and scales of values. Later, different aspects of the geological and geomorphological heritage were taken into account. In addition to the environmental impact assessment aspect (Rivas et al. 1997; Coratza and Giusti 2005), natural sites inventory systems (Serrano and Gonzales-Trueba 2005), touristic promotion (Pralong 2005) or natural parks management guidelines (Pereira et al. 2007) have been proposed. In order to minimise the subjectivity in the assessment of geosites (Bruschi and Cendrero 2005), some authors developed quantitative assessment methods (Grandgirard 1997; Coratza and Giusti 2005; Serrano and Gonzalez-Trueba 2005; Pereira et al. 2007).

From a careful analysis of this rich literature, it emerges that many attributes can determine the value of a geosite/geomorphosite. The main ones are scientific, cultural (sensu stricto), socio-economic and scenic, which then identify the landscape, the habitat, the geodiversity, the dynamics of the Earth's past processes, the history of biological and human evolution and essential resources for economic and scientific development.

The importance of geomorphosites is therefore not only related to their scientific value in learning about the planet's history, but also to an ecological and economic value (Panizza and Piacente 2003). Both attributes can be taken into account, depending on the research targets (Reynard 2005). For instance, when classifying sites to protect, the more restrictive definition should be used, because only sites of particular importance to Earth's history must be selected. On the other hand, from the point of view of geotourism or integrated management of the cultural landscape, a broader definition can be applied, in order to facilitate the analysis of

links between different sectors of culture and science. This leads to several assessment methods based on three main criteria: rarity, representativeness and integrity (Grandgirard 1999). Others, like ecological value, paleogeographic significance, educational value etc., are taken into account according to the research targets.
The different definitions and terminology for the same concepts has impeded the development of common assessment methods. Moreover, as noted by Grandgirard (1999), the choice of methods and criteria depends on the research aims.

During the last decade, the promotion of geological heritage has developed rapidly due to the creation of Geoparks and geotourism. Consequently, other values (e.g. cultural and ecological) should now be considered when assessing a geomorphosite.

The accurate assessment of a geotope's value provides the basis for effective protection and promotion of the geological heritage. An accurate assessment and comparison between different geotopes will facilitate the selection of the suitable sites and management programmes.

It is clear from a study of the available literature that the assessment of geotopes is quite challenging. The main difficulties relate to the different assessment methods and, most of all, to the great variety of sites and goals. It would certainly be difficult to assess geomorphosites solely with statistical parameters or mathematical formulae, because, as noted by Cendrero (2000), many values are subjective.

In order to apply a well-defined assessment system to the Adamello Brenta Geopark, recent international literature has been investigated. The most recent procedures proposed by different authors are summarised in subsequent tables. This study identified the most suitable assessment parameters to apply to the Geopark geosites and new parameters which can be used to improve the management programme.

Bruschi and Cendrero (2005) have recently carried out a study of the main aspects of the classification and assessment of geosites. The authors focussed on the different stages of the process: identification, classification, inventory, evaluation, protection and use. The method proposed is based on three main criteria: intrinsic quality of the geosites, possible threats, need of protection and potential use. Marks are awarded to each group.

The authors stressed the point that subjectivity is inevitably part of the assessment process, since sites cannot be selected solely on a scientific or objective basis. They proposed a method which applies different combinations of assessment parameters. The advantage is that both results and methods can be verified. The model can also be refined according to the assessment targets.

The first stage of the procedure concerns the identification of a set of criteria that may be grouped into three main categories:

Qi = scientific or intrinsic Quality
Ui = Potential Use
Pi = Potential threats and protection requirements (action urgency).

The parameters used to "measure" these criteria, are indicated in tables 1 to 3.
Each parameter has a value of (0,1,2,3 or 4).
The score for each category is related to the following formulae:

$$Qi = (A \times Wa + K \times Wk + Ex \times Wex + D \times Wd + Ag \times Wag + T \times Wt + Ch \times Wch + N \times Wn + C \times Wc) /4$$

$$Ui = (Act \times Wact + O \times Wo + Acc \times Wacc + E \times We + S \times Ws + SE \times Wse) /4$$

$$Pi = (I \times Wi + T \times Wt + CO \times Wco + P \times Wp + M \times Wm + L \times WI) /4$$

Wi represents the value of each parameter ($\Sigma Wi = 1$), when one parameter has to be differentiated from another one.

The geosite value (V_{SGI}) is expressed by:

$$V_{SGI} = (Qi + Ui + Pi) / 3 \quad [1]$$

or by:

$$V_{SGI} = Ci\ (2Qi + Pi) /12$$

where:

V_{SGI} = geosite value (0-1);
Qi = intrinsic quality (0-1);
Ui = potential use (0-1);
Pi = potential threats and protection requirements (0-1).
Ci = geosite conservation degree (0-4);

Qi - INTRINSIC QUALITY		
PARAMETERS	RANKS	
A – Abundance, rarity	4	Only one example in the region
	3	2-4 examples
	2	5-10 examples
	1	11-20 examples
	0	> 20 examples
K - Scientific knowledge	4	More than one PhD thesis; some publications in international/national magazines
	3	One PhD thesis; international/national publications
	2	One national publication
	1	Some articles in national magazines; 0 publications in regional/local magazines
	0	No publications
E_x - Usefulness as process/example * model	4	Active processes clearly visible/analysable
	2	Erosion and deposition processes not clearly defined
	0	Fossil and/or deposit forms difficult to use to interpret past processes
D - Diversity of elements of interest (geomorphological, stratigraphic, paleontological etc.)	4	5 or more elements
	3	4 elements
	2	3 elements
	1	2 elements
	0	one element only
Ag – Age (difficult, questionable criterion, which can be accepted "all other factors" being equal, the older age the higher the value	4	Mesozoic or older
	3	Cenozoic
	2	Lower Pleistocene
	1	Upper Pleistocene
	0	Holocene
T - Locality type*	4	Formally recognised type locality
	2	Secondary locality or locality of reference
	0	Not proposed as type locality
Ch - Links with historical, archeological, artistic heritage	4	Presence of archeological elements or others
	3	Presence of other type of archeological elements
	2	Archeological elements only
	1	Non archeological elements
	0	No additional elements
N - Association with other natural heritages	4	Extraordinary landscape and significant flora and fauna
	2	Extraordinary landscape or significant flora and fauna
	0	Valued landscape
C – Conservation degree	4	Well preserved, no degradation
	3	Minor risks
	2	Partially affected by human activity but site's features still intact
	1	Strongly affected by human activity with damaged features
	0	Intense degradation; loss of the site's features

Table 1. Parameters and ranks for the intrinsic quality category. The PARAMETER column lists the parameters used to calculate the value of Qi used in the mathematical formula [1]. Parameters for which only three ranks have been identified, are indicated with an asterisk (*).

Ui – POTENTIAL USE (social activity)		
PARAMETERS	RANKS	
Act - Possible activities (scientific, educational, tourism, leisure, collection of objects)	4	5 or more activities
	3	4 activities
	2	3 activities
	1	2 activities
	0	1 activity
O - Observation of conditions*	4	No access limitations, no visual obstacles
	2	Some physical access and/or visual limitations
	0	Physical access and visual difficulties due to buildings, vegetation etc.
Acc – Accessibility	4	Direct access by main road
	3	Access by local road
	2	Access by unsurfaced road or path
	1	No access road but road distance less than one km
	0	At least one km to closest road
E – Covered area (in m^2) *	4	> di 10^6
	3	10^5-10^6
	2	10^4-10^5
	1	10^3-10^4
	0	< 10^3
S - Proximity of facilities	4	Centre of > 10,000 inhabitants with sleeping and eating facilities within 5 km
	3	Centre of > 10,000 inhabitants with some facilities within 5 km
	2	Sleeping and eating facilities between 5-20 km
	1	Facilities between 20-40 km
	0	Facilities at more than 40 km
SE - Socio-economic state of the area*	4	More than 15% income per person and above national average education
	2	Within the national average
	0	More than 15% below the national average

Table 2. Parameters and ranks for the potential use category. The PARAMETER column lists the parameters used to calculate the value of Ui used in the mathematical formula [1]. Parameters for which only three ranks have been identified, are indicated with an asterisk (*).

P i - POTENTIAL THREATS AND PROTECTION REQUIREMENTS (action urgency).		
PARAMETERS	RANKS	
I – Inhabitants in the surrounding area (within a 25 km radius)	4	> 100.000
	3	50.000 – 100.000
	2	25.000 – 50.000
	1	10.000 – 25.000
	0	< 10.000
T - Present and potential threats*	4	Clear urban industrial development or plans for new infrastructure
	2	Intermediate area with no immediate development projects but clear future expectations
	0	Rural area without urban industrial and infrastructure development expectations
CO - Possibility to collect objects*	4	Fossils, minerals or rocks can be collected but with serious damage to the site
	2	Objects can be collected but with major damage to the site
	0	No possibility to collect objects
P - Existing plans	4	Area classified for urban, industrial or service use
	3	No plans exist
	2	Non protected site, but within area classified as rural in existing planning
	1	Site within area with some local/provincial protection regulations
	0	Site within national park or other protected national areas.
M - Mineral exploitation interest	4	High mineralogical interest and valid mining concessions
	3	Areas with reserves or low value resources and where mining is currently permitted
	2	Areas with reserves or low value resources and where mining is currently not permitted
	1	A few mineral resources
	0	No mineral interest
L - Landed property *	4	Site located on a private estate
	2	Public and private property
	0	Public property

Table 3. Parameters and ranks for the potential threats and protection requirements category. The PARAMETER column lists the parameters used to calculate the value of Pi used in the mathematical formula [1]. Parameters for which only three ranks have been identified, are indicated with an asterisk (*).

In the two studies published in 2005 (a,b), Coratza and Giusti illustrated a method to quantitatively evaluate the scientific quality of geomorphosites. Their methodology shows how a quantitative assessment procedure can be objectively achieved through logic and qualitative reasoning. In particular, the scientific quality (Q) of a geomorphosite is calculated taking into account the following direct or indirect parameters:

- Expert knowledge (CE), related to the scientific research (S) and educational value (D) of the geomorphosite;
- area (A), related to the total surface covered by the geomorphosite in that specific territory;
- rarity (R), related to the number of similar geomorphosites present in that specific territory;
- conservation degree (C), which depends on both natural and anthropic factors;
- exposure (E), related to the visual impact;
- added value (Z), related to the non-geological and non-geomorphological significance of the geomorphosite, which nevertheless increases its scientific value.

The asset's scientific quality is calculated according to a formula which incorporates weighted values of these parameters. The weighting factors provide a mechanism to give more importance to some parameters. The methodology is meant to optimise the decision making process in the fields of environmental impact assessment (VIA), land management planning and protection of the Geological Heritage. It is based on previous studies (Panizza et al., 1995; Barba et al., 1997; Rivas et al., 1997; Bertacchini et al., 1999 and Giusti and Gonzalez, 2000).

Scientific quality (Q) is calculated according to the formula:

$$Q = sS + dD + aA + rR + cC + eE + zZ$$

where:

S, D, A, R, C, E, Z = parameter values
s, d, a, r, c, e, = related weighting factors.

The total value of Q is then normalised (Qn) in order to obtain values between 0 and 1 according to the formula

$$Qn = Q / Qmax.$$

where:

Q = scientific quality of the geomorphosite
Qmax = maximum value possible for a geomorphosite.

Each parameter is assigned a value between 0 and 1, based on the guidelines given in table 4.

The operative scheme is also summarised in table 4.

In their paper concerning the Impact on the scientific quality of geomorphosites (2005a), Coratza and Giusti also take into account the impact of human activities. This may be physical (If) - when a geomorphosite is directly or indirectly damaged by an anthropic object/activity - and/or visual (Iv), when an anthropic object visually damages the geomorphosite or its access. Physical and visual impacts are calculated separately and are the difference between the "scientific quality" before and after a project, according to the formula:

$$I(f,v) = Q\ pre - Q\ post$$

The total impact (I) is also calculated by the formula:

$$I = I \times If + 0{,}5 \times Iv$$

	Parameter		Score		Guidelines
Ce - Expert knowledge	**S**	Scientific research value	Low	0,25	Number and quality of publications; there was or is active research; can be used to reconstruct the geomorphologic evolution; its importance for the general geomorphological history; its added value to the research. The value cannot be null, otherwise the site cannot be considered to be a geomorphosite
			Medium	0,50	
			High	0,75	
			Very High	1	
	D	Educational value	None	0	Representativeness of the form or process; if and how it is cited in teaching textbooks, e.g. its importance; if it is part of educational and/or touristic itineraries and the educational level of such itineraries; if it is also known outside the scientific community; it is believed to have educational value even if not supported by educational material
			Low	0,25	
			Medium	0,50	
			High	0,75	
			Very High	1	
	A	Area	< 25%	0,25	The larger a geomorphosite, the higher is its value (not the same for other geological assets). The value (as a percentage) is calculated as geomorphosite area/total area occupied by all the same typology geomorphosites in the considered area
			25-50 %	0,50	
			51-90 %	0,75	
			91-100 %	1	
	R	Rarity	- many similar elements in the territory	0,25	Rarity is a very significant factor, especially in terms of EIA and Land Management Planning; rarity increases if the geomorphosite represents a morphoclimatic environment different from the present one.
			- sufficient similar elements in the territory	0,50	
			- few similar elements in the territory	0,75	
			- unique element	1	
	C	Conservation	Bad conservation state	0,25	The degree of degradation of the geomorphosite; if there are any anthropic elements which have altered or partially destroyed it; presence of vandalism; if there are protective structures from both natural and anthropic agents
			Fairly good conservation state	0,50	
			Good conservation state	0,75	
			Excellent conservation state	1	
	E	Exposure	Strongly penalised	0,25	Geomorphosite visibility: the geomorphosite is suffocated by man-made objects; to see it, it is necessary to get very close; reaching the geomorphosite can be dangerous; distant views are spoilt by anthropic objects; disturbing anthropic objects very close; the geomorphosite is visible from any direction; the geomorphosite is in a scenic location and it emerges above the landscape
			Penalised	0,50	
			Not particularly penalised	0,75	
			Not penalised	1	
	Z	Added value	No added value	0	The geomorphosite also has ecological and/or naturalistic value; nearby there are geological elements which further enrich it; the geomorphosite has an historical-cultural value; it is located within a protected area; it has a touristic-economic value. (The added value represents an awareness of the geomorphosite, including non-geomorphology aspects, which remain the determining factor)
			Little importance	0,25	
			Medium importance	0,50	
			High importance	0,75	
			Fundamental importance	1	

Table 4. Summary of the methodology proposed by Coratza e Giusti (2005b)

The quantitative assessment problem was also tackled by Pralong (2005) in an article where the author proposed a method that takes into account the touristic use of the geomorphological sites. The aim of the study was:

- to propose criteria to quantify and qualify the sites in terms of aesthetic, scientific, historical-cultural and socio-economic value (Table 5)
- to assess the possible utilisation in terms of extent and manner of use (Table 5).

Pralong introduces the concept of touristic value, which includes four components: aesthetic, scientific, historical-cultural and socio-economic. Based on the degree and form of use, the touristic value is strictly connected to the utilisation one (low, medium, high). Based on the guidelines, every parameter receives a score from 0 to 1, subdivided into five levels (0, 0.25, 0.50, 0.75, 1).

Each touristic value component is determined with the aid of precise criteria and tables. For the aesthetic component (scenic), the author referred to the works of Grandgirard (1997) and Quaranta (1993); for the scientific one he based his conclusion on Coratza and Giusti (2005); for the historical-cultural Pralong followed Rojsek (1994) and Rivas et al. (1995) and for the socio-economic Panizza (1998). The touristic value is the average of these four components, as expressed by the formula:

$$Vtour = (Vsce + Vsci + Vcult + Veco) / 4,$$

where:

Vtour = touristic value
Vsce = scenic/aesthetic value
Vsci = scientific value
Vcult = cultural-historical value
Veco = socio-economic value

Each component is calculated by taking the average of all the attributes used to define it, as expressed by the following formulae. In contrast with Coratza and Giusti, Cendrero and Quaranta, Pralong does not always use "weighting" coefficients, since there is not always an objective reason to consider one specific value to be less important than another. Where necessary, the "weighting" coefficient is clearly specified.

$$Vsce = (Sce1 + Sce2 + Sce3 + Sce4 + Sce5) / 5$$

where Sce1-5 correspond to the assessment criteria expressed in table 5

$$Vsci = (Sci1 + Sci2 + 0.5 \times Sci3 + 0.5 \times Sci\ 4 + Sci5 + Sci\ 6) / 5$$

where Sci1-6 correspond to the assessment criteria expressed in table 5.
For Sci3 and Sci4 "weighting" coefficients have been introduced.

$$Vcult = (Cult1 + 2 \times Cult2 + Cult3 + Cult4 + Cult5) / 6$$

where Cult1-5 correspond to the assessment criteria expressed in table 5.
A "weighting" coefficient has been introduced for Cult2, since Cult2 can also include literary works, which are related to the amount of iconographic material.

$$Veco = (Eco1 + Eco2 + Eco3 + Eco4 + Eco5) / 5$$

where Eco1-5 correspond to the assessment criteria expressed in table 5.

The degree of utilisation is instead calculated taking into account the degree and form of use:

$$Vexpl = (Vdeg; Vmod)$$

where:

Vdeg = degree of utilisation
Vmod = form of utilisation

The relationship between these two values, will define three levels of utilisation (low, medium and high).
The degree and form of utilisation are calculated by analysing a set of attributes according to the following formulae:

$$Vdeg = (Deg1 + Deg2 + Deg3 + Deg4) / 4$$

where Deg1-4 correspond to the assessment criteria expressed in table 5

$$Vmod = (Mod1 + Mod2 + Mod3 + Mod4) / 4$$

where Mod1-4 correspond to the assessment criteria expressed in table 5.

Pralong tested his method during the geomorphological study of specific sites (glacial, karst and fluvial) in the Chamonix Mont-Blanc (Haute-Savoie, France) and in the Crans-Montana-Sierre (Vallese, Switzerland) areas. In the related article, the author presented his method and the evaluation of the touristic value. Subsequently, the utilisation value (intensity of use) was also introduced. Finally the two phases of the procedure were compared and the potential utilisation of the studied geomorphosites was analysed and discussed.

Vtour = Touristic value	Sce Scenic value	Sce 1 Number of view points	It consists of the number of viewpoints reachable by a footpath. Every view point should offer a different angle and must be less than one Km from the site
		Sce 2 Average distance between viewpoints (in m)	Total amount of the shortest distances between each view point and the site, divided by the number of viewpoints (Sce1)
		Sce 3 Surface	Surface area of entire site. For each type of site (glacier, cave etc) a quantitative scale based on the area dimensions (ha) in relation to all the identical sites present in the studied territory, is established
		Sce 4 Elevation	Elevation of entire site. For each type of site (glacier, cave etc) an elevation quantitative scale, in relation to all the identical sites present in the studied territory, is established
		Sce 5 Colour contrast with surrounding sites	Colour contrast between the site and the surrounding landscape. Any colour includes all its shades. Dark, grey and light grey are considered as the same colour
	Sci Scientific value	Sci 1 Paleogeographic interest	Paleogeographic interest of the site, as evidence of the geomorphological evolution of the territory. An historical study of the site has a greater interest
		Sci 2 Representativeness	Educational characteristics and peculiarity of the site for non-experts. The clarity of the site is based on its quality and the general configuration.
		Sci 3 Area %	The site's area divided by the total area occupied by identical sites in the studied territory as stated by Sce3. The final score is expressed as a percentage
		Sci 4 Rarity	Number of identical sites present in the studied territory as stated by Sce3. An example of a rare site could be one with a morphoclimatic environment different from the present one
		Sci 5 Integrity	It depends on the possibility of natural disasters, on natural or anthropic (infrastructure, population, vandalism) evolution. These factors influence the site and its conservation degree

		Sci 6 Ecologic interest	Interest (species rarity), diversity (species number) and dynamic nature of fauna and flora (possibility of the environment to evolve naturally)
	Cult Cultural value	Cult 1 Cultural and historical traditions	Symbolic relevance and significance of the site's heritage for the community. This criterion is defined by cultural and historical traditions, without considering physical ruins or buildings
		Cult 2 Iconographic representations	All historical images of the site are to be counted (paintings, drawings, carvings, photographs). Quality (s) can be considered to increase the score
		Cult 3 Historical and archeological relevance	Presence and relevance of buildings or ruins of historical and/or architectural and/or archeological interest. Score increases with quality.
		Cult 4 Religious and metaphysical relevance	This criterion includes popular beliefs
		Cult 5 Art and cultural events	A cultural event can be held on the site or outside. An event which no longer exists can still be given an average score.
	Eco Socio-economic value	Eco 1 Accessibility	Distance of the site from means of transport and their relevance. In case of access by cable car or train, the score scale must be appropriate
		Eco 2 Natural risks	Risk level of the site and management policy (awareness, infrastructure protection etc.) Risks of anthropic origin are not included
		Eco 3 Visitors per year in the region	Theoretical number of visitors based on the number of visitors per year to the main resorts in the region. Sites of the same region will receive the same score
		Eco 4 Official level of protection	The economic exploitation is inversely proportional to the level of protection
		Eco 5 Attractiveness	This point balances Eco 4, as the absence of protection can be an economic and touristic disadvantage in terms of attracting visitors
Vexpl = Utilisation value	Deg Degree of utilisation	Deg 1 Utilised area [ha]	Area used for the economic and touristic promotion of the site. The area may be totally or partially located on the site. It may also be located off the site.
		Deg 2 Number of infrastructures	Infrastructure related to transport, information, accommodation, visitor centres and gift shops, situated and used in the area. Footpaths are not included
		Deg 3 Seasonal use [days]	Number of days or seasons in which the site is used in a year. In case of intermittent use, the final score will be calculated as the annual average.
		Deg 4 Daily use [hours]	Number of hours per day in which the site is used. In case of variable daily use in a year, the final score will be calculated as the annual average.
	Mod Form of utilisation	Mod 1 Use of the scenic value	Use of the scenic features of the site assessed by its advertising optimisation via different types of support (Brochures, posters, website. Media etc.) and products
		Mod 2 Use of the scientific value	Use of the scientific interest of the site assessed by its didactic optimisation via different types of support (Exhibitions, guided tours, educational tools) and products
		Mod 3 Use of the cultural value	Use of the cultural interest of the site assessed by its didactic optimisation via different types of support (Exhibitions, guided tours, educational signs) and products
		Mod 4 Use of the economic value (people)	Use of the economic potential of the site based on the number of visitors per year. The score should not reflect the profit.

Table 5. Summary of the method proposed by Pralong (2005)

Based on the different methods developed over the last two decades to reduce the subjectivity in the selection of geomorphosites, Reynard et al. (2007) proposed an alternative approach. They integrated the assessment of scientific value (integrity, rarity, representativeness, paleogeographic significance) with that of added value (ecological, cultural, aesthetic and economic). In their study, the authors applied the procedure to two cases: the inventory of the Adula National Park (Ticino, Switzerland) geomorphosites and the assessment of the geocultural heritage of the Trient area (Vallese, Switzerland).

The authors emphasised how different definitions and terms used to express similar concepts, reduce the objectiveness of assessment methods. Moreover, as already noted by Grandgirard (1999), the choice of assessment procedures and criteria depend on the aims of the research.

In order to clarify the situation, Reynard et al. proposed to focus on two main sets of value (Reynard 2005a): the first set referred to the "scientific value" and the second referred to other aspects (cultural, economic, aesthetic and ecologic). The proposed method is based on a table divided into six sections (Table 6); each section consists of a series of sub-criteria. The quantitative aspects are considered in sections three (scientific value) and four (added value). The first two sections are characterised by only qualitative scores. The quantitative values vary from 0 to 1 (0 has no value, 1 has a very high value).

This method is described in detail in the following paragraphs, since it was used as the basis of the Adamello Brenta Natural Park assessment.

The *first section* consists of general data (sector 1 of Table 6). The data are expressed either in numeric form (e.g. coordinates, height, dimensions) or by a code (e.g. identification, type, properties). The identification code is subdivided into three elements (region, geomorphological process, number). In this section, details about property rights (private, associations, public organisations, Councils etc.) are also indicated, since it is extremely important for the site's management (Reynard 2005b). Sites on private estates are generally more difficult to protect (or promote) compared to those belonging to the State or organisations. Large geomorphosites, called "geomorphological landscapes" (Reynard 2005a), can belong to different bodies. The use of numeric data and codes is particularly interesting when the database is created in a GIS (Geographic Information System) environment, since spatial analyses (selection, classification etc.) can be used.

The *second section* consists of descriptive data which are based on the analyst's observations and on the study of specific documentation (maps, aerial photographs) and bibliographic sources (previous studies). The descriptions address not only the geomorphological features, but also other aspects such as archeological finds, infrastructure, biotopes etc. The morphogenetic analysis is focussed on the processes responsible for the genesis and evolution of the landscape and it can include temporal information (dating) and landscape activity. In the second phase, transformations linked to anthropic activities (if any) are also analysed.

The *third section* (quantitative assessment) attempts to estimate the "scientific value", on the basis of the restrictive definition of a geomorphosite as proposed by Grandgirard (1995, 1997, 1999). As in Grandgirard (1999), the assessment criteria are: rarity, representativeness, integrity and paleogeographic value, as defined in detail in Table 6. The paleogeographic value is necessary to keep the analysis sensitive to the Earth's history and climate. The Scientific value corresponds to the arithmetic mean of the values assigned to each criterion.

The *fourth section* is focussed on the quantitative "added value". The assessment can include one or more of the following categories: ecological, aesthetic, cultural and economic values, the characteristics of which are indicated in Table 6.

- The ecological value (ECOL) is the arithmetic mean between ecological impact (Ecl) and protected site (PS)

$$ECOL = (Ecl+PS)/2$$

- The aesthetic value (AEST) corresponds to the arithmetic mean between view point (VP) and "contrast" (STR)

$$AEST=(VP+STR)/2$$

- The cultural value is very heterogeneous and is composed of four independent criteria: religious, historical, artistic or literary and geo-historical importance. Since geomorphosites generally possess only one or two of these cultural criteria, the evaluation of the cultural value will derive from the highest score of one of these four criteria, and not from the arithmetic average.

CULT = > tra REL, HIS, ART, GEO

- The economic value is based on a qualitative and, when possible, quantitative (e.g. number of visitors, advantages etc.) assessment of the products "generated" by the geomorphosite.

As a geomorphologist may not be able to evaluate criteria outside his or her discipline (biology, history, economy), this part of the assessment is based on literature and simple criteria. The aim is not to provide a site in terms of economy, ecology, art and history, but to highlight possible links between geomorphology and natural or cultural aspects.

The *fifth section* concerns the synthesis of the whole assessment and is subdivided into four parts.

- The first part considers the "global value", which is a quantitative and qualitative sum of the scientific value and the added value.
- The second part is concerned with educational targets.
- The third part represents the danger level of a certain site. It includes, where possible, all the human and natural threats, either existing or potential.
- The fourth part proposes management measures, based on the assessment of the "global value" and danger level. These measures are divided into two groups, which cover issues of geological heritage, protection and promotion.

The *sixth section* is the literature list.

The geosite assessment method proposed in this study is rather innovative in some of his points. Previous works mainly focussed on the scientific value and were used for inventories of natural assets and for studies on the environmental impact analysis (VIA). During the last decade though, the promotion of geological heritage rapidly developed due to the creation of geoparks and to tourism. Therefore, the goemorphosite assessment must take into account other values, such as the cultural and ecological ones and the method proposed in this study follows this approach. Reynard et al. proposed the combination of scientific assessment and other specific values.

1) General data	Identification code		
	Name		
	Position		
	Coordinates		
	Maximum height		
	Minimum height		
	Type	PCT= punctiform	
		AER= areal	
		LIN= linear	
	Dimension	Punctiform	:
		Linear: length (m)	
		Areal: surface (m^2)	
	Owner of the territory or object	PRI= private	
		ASS= association	
		PUB= public	
		COM= council	
	Topographic map		
	Photography		
	Diagrams		
2) Descriptive data	Description		
	Morphogenesis		
3) Scientific value	Integrity		
	Representativeness		
	Rarity		
	Paleographic value		
4) Added values	ECOL Ecological value	Ecl Ecological impact	Geomorphosite significance for the development of a specific ecosystem
		PS Protected site	Sites already protected in national or local inventory for ecological reasons (humid zones, etc.)
	AEST Aesthetic value	VP View point	Site's visibility
		STR Contrasts, spatial structuring	Contrasts, vertical development and spatial structuring
	CULT Cultural value	REL Religious significance	Sites of «religious», «mythological» or «mystic» significance
		HIS Historical significance	History in a broad meaning (archeology, prehistory and history), it includes the presence of ruins and remains.
		ART Artistic and literary significance	Site mentioned in artistic works, books and poems.
		GEO Geo-historical significance	Role of particular sites in the development of geoscience
	ECON Economic value		Economic products
5) Synthesis	Global value		It expresses an opinion which sums the scientific value and the added values
	Educational value		Educational significance of the site (school, university)
	Threats		Natural and human existing and potential threats
	Management measures	.	Proposed actions to protect and promote the site
6) Bibliography			

Table 6. Summary of the method proposed by Reynard et al. (2007). Values on a grey background are quantitative.

Other authors dealt with the assessment and management of geosites in protected areas in a more specific way. Examples are the studies carried out in the protected area of Lesvos Island in Greece (Zouros, 2007), in the Natural Park of Montesinho in Portugal (Pereira et al., 2007) and in the National Park of Picos de Europa's protected area (Serrano et al., 2007).

In the first work, Zouros proposed a method that investigates the "geomorphological value" taking into account six criteria: 1) "scientific and educational value"; 2) geodiversity; 3) "ecological and aesthetic value"; 4) "cultural value"; 5) potential threats and need for protection; 6) potential use.

The assessment method was applied to several Greek geomorphosites from different perspectives: at a landscape level (national parks and monuments); at a landform level (Lesvos Island Geopark). In the first case, eight national parks and representative natural monuments have been classified. In the second case, fifteen distinct geomorphosites of various dimensions and categories along the coastal area of the Petrified Forest Geopark of Lesvos have been assessed. The author chose a quantitative approach. For every criterion different indices (table 7) have been defined and scores between 0-10 or 0-5 (higher scores represent higher value) have been assigned to each index.

	Criteria and indicators	Assessment	Ranking
1	**Scientific and educational value**		**40-0**
1.1	integrity	Degree to which the geomorphological structure or processes is present on the site and its level of conservation.	10-0
1.2	rarity	Number of similar sites at different levels (unique, international, national, regional, local).	10-0
1.3	representativeness	Degree to which the site is considered typical of a certain geomorphological process	10-0
1.4	exemplarity	Usefulness of the site to help the public to understand a geomorphological structure or process	10-0
2	**Geodiversity**	Number of geological and/or geomorphological phenomena in each site	**10-0**
3	**Ecological and aesthetic value**	Part of international, national or regional classification (WHS – world heritage natural site or MAB – biosphere reserve, national park or natural monument, natural park, regional park, locally protected site)	**10-0**
4	**Cultural value**	Part of international, national or regional classification (WHS – world heritage natural site or MAB – biosphere reserve, national park or natural monument, natural park, regional park, locally protected site)	**10-0**
5	**Potential threats and need of protection**		**10-0**
5.1	Legal protection	Existence of legal protection (international designation, natural park or monument, protected by national laws, regional protection, little protection, not protected)	5-0
5.2	vulnerability	Presence and size of potential threats (uncontrollable, pressure, moderate, controlled, low, none)	5-0
6	**Potential use**		**20-0**
6.1	recognisability	Acknowledgement level (international, national, regional, local, known by scientific community only, unknown)	5-0
6.2	geographical distribution	Percentage of area occupied by the geomorphosite in relation to the total surface of the protected area	5-0
6.3	accessibility	Accessibility level (by road of regional or national importance, by local road, unsurfaced road, by path, by permit only, no access)	5-0
6.4	economic potential	Number of visitors per year (more than 75.000, more than 50.000, more than 20.000, more than 5.000, less than 5000, no visitors)	5-0

Table 7. Criteria and indicators used in the assessment method.

The score for every criterion is the sum of its indicators. A geomorphosite's quality Q is the total number of credits (100 is the highest score) according to the following formula:

Q = Vse+Geo+Vee+Vc+Pmp+Pu

where:

Q = geomorphosite's quality
Vse = scientific and educational value
Geo = geodiversity
Vee = ecological and aesthetic value
Vc = cultural value
Pmp = potential threats and need of protection
Pu = potential use

Corrective coefficients for emphasising or reducing the significance of some criteria are not used in this method. Instead, different ranges (0-10 or 0-5) are attributed to the criteria, or the criteria are subdivided into more or fewer indicators.

In this way, it is possible to arrange a scale of values for different geomorphosites. The scientific value, potential use or other parameters though, are not evident from this scale. They could be used separately to make different choices (protection, exploitation etc.). The criteria are anyway very similar to those used by other authors that have been discussed. Some are subdivided into indicators (scientific and educational value, potential use), others are used in a less detailed way.

Pereira et al. (2007) based their study on another European park, the Natural Park of Montesinho (Portugal), with a surface area of approximately 750 km^2. When the natural park was established (1979), the geological and geomorphological aspects were not taken into account in the conservation policies. The geological heritage was assessed later. In the method followed by Pereira et al., the geomorphosites are initially categorised into three groups: single locations, geomorphological zones and panoramic view points.

Two main phases (inventory and quantification of the sites) follow. During the inventory the geosites are identified, selected and characterised by: a) identification of the potential geomorphosite, b) its qualitative assessment, c) selection of the geomorphosite, d) characterisation of the geomorphosite. In the quantification phase, the significance of the site is determined by the attribution of values and a classification.

The values are expressed numerically with the use of selected criteria. The criteria refer to attributes which have already been considered in part or completely by other authors. Following this method, 154 potential geomorphosites were identified in the Natural Park of Monteshinho, of which, only 26 were selected after the qualitative assessment or the processes' characterisation. The numeric evaluation and the position of the sites, reduced the final list to 13.

he authors identified a series of "geomorphological indicators", the scores of which are utilised in the general assessment according to table 8, either aggregated or disaggregated. The indicators are:

Scientific value (**ScV**) = (Ra+In+Rp+Dv+Ge+Kn+Rn); maximum score 5.5
where:

Ra = rarity related to the area (0-1)
In = integrity (0-1)
Rp = representativeness (0-1)
Dv = geodiversity (0-1)
Ge = other geological features with a geological heritage value (0-0.5)
Kn = scientific knowledge on geomorphological topics (0-0.5)
Rn = rarity at a national level (0-0.5)

Use value (**UsV**) = (Ac+Vi+Gu+Ou+Lp+Eq); maximum score 7.0
where:

Ac= accessibility (0-1.5)
Vi= visibility (0-1.5)
Gu= present use for geomorphological interest (0-1)
Ou= present use for natural or cultural interest (0-1)
Lp= legal protection and limitation of use (0-1)
Eq= logistical support (0-1)

Added value (**AdV**) = (Cult+Aest+Ecol); maximum score 4.5
where:

Cult = cultural value (0-1.5)
Aest = aesthetic value (0-1.5)
Ecol = ecological value (0-1.5)

Protection value (**PrV**) = (In+Vu); maximum score 3.0
where:

In = Integrity (0-1)
Vu = vulnerability (0-2)

Principal phases	Subphases				V max
Inventory	I. identification of potential geomorphosite	Scientific value	ScV		5.5
		Aesthetic value	Aest	AdV	4.5
		Cultural value	Cult		
		Ecological value	Ecol		
	II. Qualitative assessment	Essential value			
		Potential use	UsV		7.0
		Protection request	VPr= (In + Vu)		3
	III. Selection of the geomorphosite	Based on the scores from I e II			
	IV. Characterisation of the geomorphosite	Detailed description (for selected sites only)			
Quantification	V. Attribution of values	Geomorphological value (scientific v. + added v.)	Scv+AdV		10
		Management value (use value + value's protection)	UsV+VPr		10
	VI. classification	Synthesis table with all single values			

Table 8: Phases and scores attributed to geomorphosites for their assessment. For numeric evaluation and single values, refer to the detailed tables in the article. The value attribution phase is highlighted in grey.

Compared to other ratings methods, the numerical assessment (point V of table 8) of this method creates two levels, which according to the authors, represent principal and secondary indicators. The first principal indicator, "geomorphological value", includes the secondary indicators, "scientific value" and "additional values". The second principal indicator, "management value" integrates the secondary indicators, "use value" and "protection value". The weighting of both principal indicators is the same (10 points max). The sum of all the indicators determines the total value of the goemorphosite. This kind of scale allows classifications that can take into account different assessment targets: protection and/or promotion of geomorphosites.

Another characteristic of this method, not always evident in other methods, is the disaggregated recording of the numerical evaluations: all data are recorded on the same table, so a direct comparison between individual parameters is possible. Moreover, principal and secondary indicators (geomorphological and management values), together with the total value, are highlighted (table 9). In this way geomophosites can be classified in relation to one particular parameter and even when they present a low total value, they can be considered of higher value in a specific sector.

The authors do not propose weighting coefficients, instead they use different levels of scores (0-1, 0-1.5, 0-2), with differentiated step frequency (3,5,7,8). These assessment differences have not been motivated by the authors.

Classification	Scientific value **ScV**	Added value **AdV**	Geomorphological value **GmV**	Use value **UsV**	Protection value **PrV**	Management value **MnV**	Total value **TtV**	Final classification **Rk**
1	**L06**(5,00)	**L07**(3,62)	**L09**(7,58)	**L05**(6,01)	**L08**(3,00)	**L05**(8,76)	**L08**(15,37)	**L08**(23)
2	**L09**(4,83)	**L17(**3,37)	**L03**(7,41)	**L08**(5,33)	**L21**(3,0)	**L08**(8,33)	**L05**(14,84)	**L21**(36)
3	**L03**(y,y)	**L13**(y,y)	**L06**(y,y)	**L21**(y,y)	**L12**(y,y)	**L21**(y,y)	**L21**(y,y)	**L05**(y,y)
4	**L08**(z,z)	**L11**(z,z)	**L17**(z,z)	**L11**(z,z)	**L26**(z,z)	**L11**(z,z)	**L11**(z,z)	**L11**(z,z)
n								

Table 9. Results of geomorphosite numerical assessment. From Pereira et al. (2007). ***L 0X*** *is the code assigned to each geomorphosite and the number in brackets is the score.*

Another example is provided by Serrano et al. (2007), with their study of a protected area in the Cordillera Cantabrica, Northern Spain: the Picos de Europa National Park, the first Spanish territory to be declared a National Park. The landscape is characterised by glacial and karst landforms, an elevated mountain environment with an oceanic climate (humid) and environmental changes induced by mining and tourism. The aim of the study was to develop a method for the assessment of local geomorphosites that could be applied to other protected natural areas. The work produced an inventory of the geomorphosites as well as a natural assessment, which focussed on the management of the sites.

The method is based on the creation of a detailed geomorphological map, in order to identify landforms and processes and interpret the landscape evolution. Descriptive and analytic cards were produced for each selected site. The cards describe the most important geomorphological features such as: morph structures, bedrock, landforms, observed dynamics, singular elements, management, past human and cultural characteristics, natural fragility, present land uses, cultural values and vulnerability.

The cards also indicate the three assessment scoring criteria: scientific value (intrinsic value), cultural value (added value) and the use and management value. Twenty two geomorphosites of different sizes and categories were classified and compared; their possible use is based on the conservation priorities of each site. The authors also stressed the point that an assessment cannot be performed by statistical parameters or mathematical formulas, since, as stated by Cendrero (2000), a geomorphosite has an intangible value. Nonetheless, it is important to develop a method which is the most objective possible and which can guarantee a comparative assessment.

The descriptive card is very interesting. It analyses the geomorphosite from different points of view and includes geomorphological (type, origin, landforms' description, dynamics, landforms' chronology, main interest, secondary interest) and utilisation (cultural topics, accessibility, interest level, conservation state, present use, transport, infrastructures, impacts, protection legal situation) information. Compared to other methods, the value attribution phase is much simpler. Scientific, cultural and utilisation aspects are assessed. When considering the scientific aspect, the number of elements which affected the system was taken into account, namely: the number of genetic processes, the number of landforms, the number of elements which testify to the past, the number of periods (in terms of chronology), the rock variety, the number of visible geological and sedimentary structures etc. A maximum of 10 individual elements were used for each site and the maximum total score is 100 (10 categories, maximum 10 points each). In the final stage, the score will be scaled to the range 0 to 10, in order to be comparable with the different scale used for the added value and for the utilisation value.

The added value represents the aesthetic, cultural, educational, scientific and touristic aspects that already exist or potentially exist. To each of these aspects (in turn divided into subcategories) a maximum of 5 points (educational, scientific and touristic) or 10 points (aesthetic and cultural) are assigned, giving a total of 70 points. Also in this case, in the final stage the scores will be scaled to the range 0 to 10, for the same reason as stated above. For the assessment of the use and management values, three categories are defined, based on the detailed knowledge of the intrinsic and added values: high (2 points), potential for use while guaranteeing conservation; medium (1 point), potential for use with appropriate management; low (0 points) impossible to use without proper management and risk of deterioration. The individual scores are kept separate and summarised in a final table.
Further comparisons can be performed based on a binary scoring system (present = 1, absent = 0) and the significance of each attribute can be compared, in order to evaluate the intrinsic and added values, in parallel with the use and management values.

<table>
<tr><th></th><th colspan="2">Elements</th><th colspan="2">Points</th></tr>
<tr><td rowspan="9">Scientific value (intrinsic)</td><td colspan="2">Genesis</td><td colspan="2" rowspan="9">Max 10 for each category and subcategory (max tot. 100)</td></tr>
<tr><td rowspan="3">Morphology</td><td>morph structures</td></tr>
<tr><td>Erosion landforms</td></tr>
<tr><td>Accumulation landforms</td></tr>
<tr><td rowspan="2">Dynamic</td><td>Ancient processes</td></tr>
<tr><td>Current processes</td></tr>
<tr><td colspan="2">Chronology</td></tr>
<tr><td colspan="2">Lithology</td></tr>
<tr><td colspan="2">Geological structures</td></tr>
<tr><td colspan="2">Sedimentary structures</td></tr>
<tr><td rowspan="5">Cultural value (added)</td><td colspan="2">Landscape and aesthetic</td><td>Max 10</td><td rowspan="5">max 70</td></tr>
<tr><td rowspan="3">Cultural</td><td>Heritage</td><td rowspan="3">Max 10 for each subcategory(max tot. 30)</td></tr>
<tr><td>Cultural content</td></tr>
<tr><td>Historical content</td></tr>
<tr><td>Educational</td><td>Ed. resources</td><td>Max 5 for each subcategory (max tot. 10)</td></tr>
</table>

		Ed. levels		
	Scientific	Scientific value	Max 5 for each subcategory (max tot. 10)	
		representative value		
	Touristic	Real	Max 5 for each subcategory (max tot. 10)	
		Potential		
Use and management values	Accessibility		High (2) Medium (1) Low (0)	
	Fragility			
	Vulnerability			
	Intensity of use			
	Degradation risk			
	State of conservation			
	Impact			
	View quality			
	Acceptable change limits			

Table 10: Summary of the scheme and scores used in Serrano et al. (2007)

The authors also introduced an interesting summary of the geosites on the basis of their characteristics. The classifications take into account the scientific, cultural and use/management values in their five evaluation levels. Four groups of geosites with similar characteristics were identified (Table 11) and the scheme is very useful for the planning of common activities (protection, exploitation, promotion).

	Vi	Va	Vu Vg	Characteristics
A	**X**	**X**		I) Most important and most visited geomorphosites. Requires the management of the number of visitors to avoid loss of value. Occasional impact due to difficult access to some areas, good conservation of inaccessible sites; irreversible damage risk of some sites. Some landscape elements are of regional and national importance.
MA				
M			**X**	
MB				
B			**X**	
A				II) Geomorphosites of high intrinsic and added value, with high use value. Due to ease of access, use and visits must be properly regulated: traffic (either internal or in transit) must be limited according to environmental capacity. Since natural dynamics predominate over human impact, poor accessibility favours their conservation. In these cases, conservation must be a priority.
MA			**X**	
M	**X**	**X**		
MB				
B				
A			**X**	III) Geomorphosites of low intrinsic and added value but in a good conservation state with high use and management values. Planned intervention requires studies on sustainability and use capacity. Each geomorphosite presents problems and limited potential that must be taken into account in order to adopt appropriate management measures.
MA				
M				
MB	**X**	**X**		
B				
A				IV) Mainly karst caves, the forms and dimensions of which make them representative of the Picos de Europa; they are exceptional on a national and international scale. Low intrinsic value, but excellent scientific, educational and sporting interests. Because of the natural fragility, intensity of use, mass tourism must be limited to avoid an irreversible loss of value. Suitable management would include the promotion of research and cave exploration.
MA				
M				
MB				
B	**X**	**X**	**X**	
Vi = intrinsic value; Va = added value; Vu-Vg = use and management value A = high; MA = medium-high; M = medium; MB = medium-low; B = low.				

Table 11: Assessment and management orientations of geosites (Serrano et al. 2007)

The table in annex 1 summarises all the attributes used by various authors to characterise a geosite. From the table it is possible to deduce:

- the characteristics considered to be the most important;
- similar parameters but expressed with different terminology;
- a series of attributes used either aggregated or disaggregated to identify properties of higher level.

A critical analysis of the table reveals a number of attributes to be considered in the assessment of every geosite in the Geopark.

National Geological Survey inventory table of the Italian GEOSITES

For some time, many methods have been adopted, to systematically gather all the characteristics and attributes of natural assets. Most of these methods favour the purpose for which they were conceived. However, they have in common a preliminary phase which involves the systematic collection of data and metadata.

The use of cataloguing in this sector of the Earth Sciences started when it was realised that the elements necessary for an environmental assessment have to be storable, updatable, implementable according to well defined criteria and, possibly, common to all. The first procedures consisted of a series of descriptive cards specifically prepared to meet special needs, often local. Technological developments have radically changed archiving procedures[2]. Data recorded on descriptive cards may now be stored in computerised databases, which are capable of storing vast amounts of information; they are easily modifiable and searchable.

In order to record geological assets, it has been necessary to create a card suitable for archiving in a geographic database. Many cards only considered qualitative aspects, for example the widely used card proposed by the former National Geological Survey. The first official census of the Trentino geosites (Avanzini, Carton, Seppi, Tomasoni, 2005) was based on this card.

In 2000, the above mentioned National Geological Survey started the project "Conservation of the Italian geological heritage", aimed at creating a coordination centre for all the information relating to the knowledge, promotion and conservation of the geological heritage and at providing the public administration with an appropriate tool for land management planning. Among the various goals, there was one which would integrate data into an "experimental card for the geosites' inventory". This would consist of a card to be used for the geological survey and its corresponding computerised information (Annex 2).

Initially the Geological Survey decided to use the existing card "Survey of sites of geological interest", which had been previously prepared by a committee (Brancucci G., Carton A., Pavia G.) within the project PROGeo Italia (Brancucci, Carton & Pavia, 1999). The card had been used in Liguria for the identification of geological sites in the region (Brancucci and Burlando 2002) and was later amended by other research projects (MIUR COFIN 2001-2003, Geosites in the Italian landscape). It was eventually adopted by the Geological Survey in an agreement with the Polis

[2] The strong point of this archiving method is the direct link between the database and the Territorial Information Systems (SIT), which are normally used by all land management bodies. A SIT linked to a geographic database allows the data to be filtered by date, to maintain the historical sequence of different investigations, to merge data from different sources and, most of all, the clear representation of several thematic areas (Marchetti, 1999).

Department of Genoa. After further revisions, in 2003 the card was transferred to the "Protection of the Geological Heritage" sector of APAT (Agency for the Environmental Protection and Technical Services). Today the table is used for the collection of data in geosites surveys, and a national DB (Database) "Geosites" (Auteri, Brancucci, Colacchi, D'Andrea, Duronio, Gramaccini, Lisi, Iugeri, Recchia, 2005) has been developed based on its structure.

The informatics database, is based on a basic table with the principal site data; a series of auxiliary tables are linked to the main one and contain data related to the location, scientific interest, description, iconographic documentation, characteristic elements, use of the site, use of the soil, territorial constraints, conservation state and protection plan. In a reserved area, comments, notes and the bibliography can be recorded in a word document, which can also contain multimedia files, photographs and maps. Data entry is via a user interface screen that makes extensive use of drop down menus, in order to reduce keyboard inputs. An example of the card in question is reported in annex 2.

C.2 Assessment of the Adamello Brenta Geopark geosites

From the numerous scientific works consulted, it was found that the attributes used for qualifying a geosite are a little under fifty, even though some of them seem to use different words to indicate similar concepts. The attributes are grouped into categories suitable for identifying the scientific, cultural, economic, educational values, together with the added value, the ecological value and the potential use. For the quantitative assessment of the Adamello Brenta Geopark's geosites, the parameters have been carefully chosen (cf. previous chapter) depending on:

- particular geographic location in the Geopark
- existing organisation (Adamello Brenta Natural Park) which already regulates the territory
- the objectives of the quantitative assessment

In the case of the Geopark, the assessment focussed on the scientific value of the geosites, together with the added value, which is acquired by virtue of certain characteristics, the usability and some protection aspects. The result was a simplified assessment card, which may be improved and updated during the study. For every geosite, four values were defined. They form a scale of merit within the scientific value and contribute to an accurate classification, which can be used for the promotion, protection and use of the site. The scores given to various attributes range from 0 to 4, which is in line with some authors, who have proposed similar assessment criteria. In order to use the results in a disaggregated way, averages or sums of different values (scientific, added and use), were not calculated. Neither were "weighting factors" introduced to emphasise certain aspects, since in this phase it is not necessary.

In the assessment of the geosite and in the identification of the possible types of intervention, the issue of vulnerability has been addressed taking into account only the potential risk of degradation/impoverishment, which is divided into two categories:

- risks of anthropic origin, linked to use and tourism
- risks of natural origin, due to active natural processes.

These risks may damage the geosite either partially or permanently, or they may seriously modify the processes responsible for its existence and present evolution.

The first risk category includes for example erosion due to trampling, collection of samples, fossils, minerals, cave's concretions, water pollution etc. To the second category belong natural processes like slope erosion, rock wall collapse, melting of glaciers and obscuring the view of the geosite by vegetation cover.

Vulnerability can strongly affect the potential use and promotion of the geosite. In order to compare the total value (sum of scientific value, use, added value and vulnerability), the lowest score (1) is assigned to high vulnerability and the highest score (4) to no vulnerability.

Any programme aimed at the use and promotion of a geosite has to take into account the degree of vulnerability and the different types of potential degradation risks; consequently, appropriate measures aimed at the conservation of the site have to be implemented.

The geosites' use also affects flora and fauna, which are not considered in the definition of vulnerability for the geosite. Therefore, when planning the use of the site, the biological aspect has to be taken into account, according to the protection and management regulations already applicable for the protected area and the constraints stated in the Park Plan.

In the following table the potential natural and anthropic causes of vulnerability are shown for each geosite category.

Geosite category	Natural Vulnerability	Anthropic Vulnerability
Glacial and periglacial morphologies	Climatic changes (glacier shrinkage and rock glacier morphological modifications)	Trampling on glacier surface, displacement of snow masses, trampling on moraine margins
Karst morphologies		Removal of cave concretions, disturbance of hypogean fauna, microclimatic balance changes, subsoil pollution, surface hydrography changes
Sites of geological significance	Superficial morphology modification due to climatic changes or other natural causes	Vandalism, removal of samples and specimens, frequent trampling outside trail, manufacturing products, infrastructure and earthworks
Demo-ethno-anthropologic sites	Degradation of original structures	Modification of original asset's structure, manufactured products and infrastructure

The assessment grid is represented by the table at the end of this section.

Scientific Value (VS)

Integrity (I)

Definitions: bad, discrete, good, excellent.
Score: from 1 to 4 (4 steps)
Comment: degradation in the degree of conservation reduces the scientific value.
Notes: it is also defined as the degree of conservation by many authors. It depends on natural and anthropic factors, like the degree of natural degradation which affects the geomorphosite; the presence of anthropic elements which modify or partially destroy the site; the presence of vandalism and structures which protect the site from natural and anthropic degradation agents. This aspect will be monitored and can change; it will be susceptible to modification, depending on the sustainable use of the geosite.

Representativeness (Rp)

Definitions: none, low, medium, high, very high.
Score: from 0 to 4 (5 steps)
Comment: an increase in representativeness lead to an increase in the scientific value
Notes: it refers to the form and/or process which characterises the geosite; it gains value if the geosite is also known outside of the scientific field and is believed to have educational value, even if not proved by educational material. It must represent a specific geological/geomorphological phenomenon. For example a series of grooved fields is representative of a karst landscape, even if not an exemplary one.

Rarity (Ra)

Definitions: >7 samples; 5-7; 3-4; 1-2; unique.
Score: from 0 to 4 (5 steps)
Comment: the greater the number of similar geosites in the studied area, the lower the scientific value.
Notes: it is assessed in relation to the number of geosites of the same category that are present in the Adamello Brenta Geopark. Geomorphosite rarity is a very important element in the assessment of its use (measured in terms of protection and preservation), especially when part of a VIA or Land Management plan. Rarity value increases when the geosite is the only example of a morphoclimatic environment that is different to the current one. The values (from 1 to > 7) may vary depending on local situations. Each author, working in different areas, applies different values.

Paleogeographic value (Vp)

Definitions: low, moderate, high, very high.
Score: from 1 to 4 (4 steps).
Comment: an increase in the paleogeographic value leads to an increase in the scientific value.
Notes: it must refer to geomorphosites no longer in equilibrium with the present morphoclimatic environment (e.g. rock glacier relicts) or to significant geosites where past event traces (underwater landslides, cross-stratification etc.) are visible.

Educational exemplarity (Ed)

Definition: low, medium, high.
Score: from 0 to 4 (3 steps)
Comment: an increase in the educational exemplarity leads to an increase in the scientific value.
Notes: dependant on the presence of active processes which are still visible and interpretable and on the geosite's interpretative clarity and its similarity with interpretative models. The value increases when the site is cited as an example in educational textbooks (Val di Fumo, geomorphosite n. 18 cited and depicted in the

universitary textbook of Geomorphology (Castiglioni, 1986) as an example of a glacial valley).

Diversity of elements of interest (D)

Definitions: 1 element; from 1 to 3, > 3
Score: from 0 to 4 (3 steps)
Comment: an increase in the number of elements of interest leads to an increase in the scientific value.
Notes: it refers to different types of elements of interest such as geomorphological, stratigraphic, paleontological etc., within the same geosite. It normally assumes high values corresponding to the geosite area.

Research value (Vr)

Definitions: low, medium, high, very high
Score: *from* 1 to 4 (4 steps)
Comment: an increase in the research value leads to an increase in the scientific value.
Notes: it refers to past, present and future research projects. The research value cannot be zero, otherwise the proposed geosite cannot be considered as such. It depends on the quality of publications related to the goesite; on the level of the goesite's representativeness in relation to the geomorphological evolution and geological history of the studied area; on its significance for the general geomorphological history; on the contribution of its added value on scientific research; on past and/or present active research projects.

Knowledge level (Lc)

Definitions: none; articles in local and regional magazines; one degree thesis, one scientific article at national level; one PhD thesis and/or one scientific article at national or international level; more than one PhD thesis and/or one scientific article at national and international level.
Score: *from* 1 to 4 (5 steps).
Comment: an increase in the number of publications and the popularity of the magazine leads to an increase in the scientific value.
Notes: it refers to the quality and quantity of articles and publications where the geosite is mentioned or studied. They range from articles in local newspapers to publications in international magazines and/or PhD theses. In the specific case of the Adamello Brenta Geopark, this value will assume a definitive significance only when the collection of the geological/naturalistic bibliography regarding the Park is complete. This work is already in progress and is planned as a strategic action in the present Plan.

Use (Fr)

Visibility (V)

Definitions: difficult, limited, good, excellent.
Score: *from* 1 to 4 (4 steps)
Comment: high visibility encourages use.
Notes: defined by some authors as exposition, it takes into account the site's visibility. A site covered by a forest or with difficult access, would be less visited than a site easily visible from different viewpoints. Also to be considered are: whether the site is suffocated by anthropisation (it is necessary to get very close in order to see it); whether it is dangerous to get close to it; whether there are anthropic elements which disturb the view either from far or nearby; whether the geosite is clearly visible from every angle; whether the geosite is located in a panoramic setting and is prominent.

Ways of access (Mr)

Definitions: on foot; by bicycle, bus, car, motorbike, cable cars.
Score: 0,75 to 2,5 (2 steps)
Comment: access only on foot or by bicycle would reduce the use
Note: it considers various transportation means, both public and private, including cable cars.

Accessibility (Ac)

Definitions: T, E, EE, EEA.
Score: *from* 1 to 4 (4 steps)
Comment: difficulty of access reduces use.
Notes: in the Adamello Brenta Geopark case, accessibility is predominantly by mountain trails, characterised by a range of difficulties: long walks along wide park roads, narrow winding roads in middle mountain areas or along high altitude trails, which can include technical sections on rocks that do not require specialist climbing skills. For this reason, CAI (Italian Alpine Club) and SAT (Tridentine Alpinists Society) adopted a system of graded treks according to difficulty. The trekking difficulty grades are analogous to alpinistic ones and express an overall assessment of the route. Note that the "Touristic" (T) category, roads suitable for vehicles were included, unlike CAI's classification.

T = touristic. It includes itineraries that: use mule tracks or easy paths; present well defined routes and therefore do not cause confusion, difficulties or orientation problems; normally are below 2000 m and present a maximum difference in altitude of 400-500 m, the walk does not last longer than 2-3 hours. They require a certain knowledge of the mountain environment and physical preparation suitable for walking. They normally lead to mountain pastures or refuges.

E = hiking. These are the most numerous and widespread routes. They include itineraries that: follow paths or signs on the terrain (pastures, debris, stony grounds); they can be long, follow smooth, uneven and even very narrow

terrain; they can include flat or slightly inclined snow areas (in the event of a fall, sliding will be short and not dangerous). Sometimes they are open areas with no paths, but are well signposted. They may traverse steep slopes (exposed parts are generally protected with barriers or secured with special equipment or cables attached to the rock). They can include rock passages, which require the use of hands for balance, or the use of technical aids (ladders, rungs, metal cables), but they do not require specific equipment (harness, carabiners etc.). These routes require rather good orientation skills, a minimum level of experience and knowledge of mountains, walking fitness and appropriate shoes and equipment.

EE = expert hikers. The routes are generally marked, but require a certain ability to move across different types of terrain: steep and treacherous (steep slopes or slippery grass slopes, or a mixture of rock and grass or rock and debris) terrain; varied high altitude terrain (with stony ground, small non-steep snowfields, open slopes without reference points etc.); on rocky areas with a moderate level of technical difficulty (equipped in places with appropriate climbing aids). Mountain experience is required, together with being sure-footed, no vertigo, appropriate equipment and physical preparation. For the equipped sections, knowledge of climbing devices (harnesses etc.) is required. Routes on glaciers (even on flat ones and/or without crevasses) are not included because it would require specific equipment and mountaineering knowledge.

EEA = for experienced hikers with appropriate equipment. Same characteristics as EE, but in addition to the physical and technical skills mentioned above, the use of climbing devices is also required.

Time required to reach the geosite (Tg)

Definitions: more than four hours; between two and four hours; from half an hour to two hours; no more than half an hour.
Score: *from* 1 to 4 (4 steps)
Comment: increased journey time reduces use.
Notes: travel time refers to the time to travel by foot or mountain bike, it also includes the time spent on chair-lifts and cable cars if they are part of the route. The time spent on motorised vehicles is not included. Moreover, the concept of travelling time is referred to as "physical effort", which is an important discriminating factor in the context of use of the goesite.

Time required to reach facilities (Ts)

Definitions: more than four hours; between two and four hours; from one hour to two hours; no more than half an hour.
Score: from 1 to 4 (4 steps)
Comment: increased journey time reduces use.
Notes: in addition to Information and Visitor Centres, all those facilities which can offer rest/refreshments, shelter and accommodation in the event of bad weather or overnight stay, are considered. Hotels, restaurants, refuges, shelters, alpine huts etc. are included in this category. Travel time refers to the time to travel by foot from the geosite.

Current intensity of Use (Ua)

Definitions: low, medium, high
Score: *from* 0 to 4 (3 steps)
Comment: an increase in the intensity of use leads to an increase in use.
Notes: most authors identify this aspect with the number of visitors per year. It is also linked to the kind of activities that can be performed. For instance, school trips increase and prolong the intensity of use, while touristic activities are confined to a certain number of months in a year. This value can be improved by a systematic monitoring programme of all the geosites.

Intensity of Potential use (Up)

Definitions: low, medium, high
Score: *from* 0 to 4 (3 steps)
Comment: to be considered in future plans for the promotion and improvement of geosites.
Notes: it is based on an estimate of how high the intensity of use could be when related to the geosite's scientific value and after the implementation of appropriate logistic, cultural, educational and promotional actions.

Possible Activities (As)

Definitions: one; from one to three; more than three
Score: *from* 0 to 4 (3 steps)
Comment: an increase in the number of activities leads to an increase in use.
Notes: the possible activities are scientific, educational, touristic and promotional. The number of potential activities depends not only on the scientific value of the geosite, but also on the logistics (long travelling time for school groups, EEA accessibility for tourists etc.)

Property situation of the asset (Pb)

Definitions: private; public.
Score: *from* 0,25 to 0,5 (2 steps).
Comment: geosites located on private property are more difficult to manage.

Added Value (Va)

It represents an awareness of the geomorphosite and it can also include non-geomorphological aspects, even though geomorphology remains the main determining factor.

Ecological (Ec)

Definitions: low; medium; high.
Score: *from* 0 to 4 (3 steps).
Comment: interest (rarity of species), biodiversity (number of species) and fauna and flora dynamics.
Notes: The ecological impact takes into account the possible creation of a particular ecosystem or the presence of particular fauna and vegetation in the geomorphosite (for instance a moraine that

supports the presence of a marsh with orchids; this would merit a higher score). If the ecological value is absent, it may not be possible to classify the site as a geosite.

Spectacularity (Sp)

Definitions: *low; high*
Score: *from 1 to 3 (2 steps).*
Comment: it is based on a perception of different kinds of strong contrasts by a visitor, or on "peculiar" natural forms.
Notes: It is also defined as "exposure" by some authors, while for others it contributes to the identification of the geosite's scenic value and is related to the visual impact. Contrasting landscapes, or landscapes with vertical features or with special elements which stand out (including a chromatic contrast between the site and the surrounding area), are generally considered more beautiful. An example could be the Campanile Basso (geosite n. 33) in the Brenta Group, or the spectacular Amola moraine banks (geosite n. 8).

Cultural (Cu)

Definitions: no elements; 1 element; 2, 3, >3 elements
Score: from 0 to 4 (5 steps)
Comment: it may be religious, historical-archeological, artistic-literary, geohistorical and iconographic.
Notes: the religious cultural value interests those sites which are somehow linked to religious, cultural or mystic traditions. The historical value has a broad meaning, including archeological, prehistorical and historical elements. It also takes into account remains and ruins. This criterion takes into account not only the role of an object in a political history sense (e.g. castles in narrow glacial valleys), but also its importance for tourism (e.g. waterfalls, among the first geosites to be used as touristic attractions) or for alpine exploration history (e.g. the boulder under which the first Adamello's explorers found shelter). The artistic-literary value includes the presence of a specific geosite in artistic works (e.g. paintings, sculptures, books, poems etc.). The geohistorical value is related to the role that a site played in the development of geosciences.

Presence of elements of attraction (Er)

Definitions: no; yes.
Score: *from* 1 to 3 (2 steps)
Comment: a high number of elements of attraction increases the added value.
Notes: the concept "element of attraction" refers not only to naturalistic and historical features, but also to the presence of logistical structures that may attract tourists, such as shelters, alpine huts, restaurants, agritourism, fishing and sport facilities, picnic facilities etc. A tourist may visit one of these attractions independently to visiting a geosite.

Protection (Tu)

Definitions: NPAB (Adamello Brenta Natural Park); PUP (Provincial Urban Plan)
Score: *from* 0,5 to 1 (2 steps)
Comment: it takes into account different levels of constrain faced by the geosites within the protected area, compared to those placed outside.
Note: the assessment only relates to the degree of protection guaranteed by current regulations.

Vulnerability (Vu)

Definition: natural (Vn) and anthropic (Va).
Score: 1 – 4
Comment: it is considered anthropic, when there is a potential risk associated with the use of the site, which would compromise, even partially, its integrity, with respect to the original conservation state. It is considered natural, if an element of risk is identified in degradation processes active in the Geopark which could compromise the integrity of the geosite.

Formulae:

Scientific Value: (I+Rp+Ra+Vp+Ed+D+Vr[1]+Lc[1])

Use: Fr=(V+Mr+Ac+Tg+Ts+Ua+Up+As+Pb)

Added Value: Va=(Ec[1]+Sp+Cu+Er)

Vulnerability: Vu=(Vn + Va)

Total Value: Vt=(Vs+Fr+Va+V)

[1]Values indicated in red do not affect the total value in this phase.

Valore Scientifico			valore
Integrità	cattivo	1	
	discreto	2	
	buono	3	
	ottimo	4	
Rappresentatività	nessuna	0	
	bassa	1	
	media	2	
	alta	3	
	altissima	4	
Rarità	>7	0	
	5-7	1	
	3-4	2	
	1-2	3	
	unico	4	
Valore paelogeografico	basso	1	
	moderato	2	
	alto	3	
	molto alto	4	
Esemplarità didattica	bassa	0	
	media	2	
	alta	4	
Diversità elementi di interesse (geomorfo., stratigr., paleont., ecc.)	1 elemento	0	
	1< elementi < 3	2	
	3 > elementi	4	
Valore per la ricerca*	basso	1	
	medio	2	
	alto	3	
	molto alto	4	
Livello conoscenza**	nullo	0	
	note e articoli in giornali locali e regionali	1	
	1 tesi laurea 1 articolo scientifico nazionale	2	
	1 tesi phD, articoli scientifici naz/internaz	3	
	> 1 tesi phD, articoli scient. naz/internaz	4	
Totale			
Totale * **			
Valore % (max punteggio 32=100%)			

Fruibilità			valore
Visibilità	difficoltosa	1	
	limitata	2	
	buona	3	
	eccellente	4	
Modalità di raggiungimento	piedi	0,75	
	bicicletta	1,50	
	bus-auto moto-imp. Ris	2,5	
Accessibilità	EEA	1	
	EE	2	
	E	3	
	T	4	
Tempo raggiungimento geosito a piedi	>240 min	1	
	120-240 min	2	
	30-120 min	3	
	0-30 min	4	
Tempo raggiungimento centri di servizio a piedi	>240 min	1	
	120-240 min	2	
	30-120 min	3	
	0-30 min	4	
Intensità d'uso attuale	bassa	0	
	media	2	
	alta	4	
Intensità d'uso potenziale	bassa	0	
	media	2	
	alta	4	
Attività che possono essere svolte (scientifica, edu, turistica, divulg.)	1 attività	0	
	2 attività	2	
	attività >=3	4	
Proprietà bene***	privato	0,25	
	pubblico	0,50	
Totale			
Valore % (max punteggio 31=100%)			

Valore Aggiunto****			valore
Ecologico	basso	0	
	medio	2	
	alto	4	
Spettacolarità	bassa	1	
	alta	3	
Culturale: religiosa, storico-archeologiaca, artistico-letteraria, geostorica, iconografica	nessuno	0	
	1	1	
	2	2	
	3	3	
	>3	4	
Presenza di elementi di richiamo (rifugi, malghe, ristoranti, agriturismo, pesca sportiva, ecc.)	no	0	
	si 1	2	
	si >1	4	
Totale			
Valore % (max punteggio 11=100%)			

Tutela		valore
PNAB	1	
PUP	0,5	
Totale		

Vulnerabilità			valore
Antropica (Va)	alta	1	
	media	2	
	bassa	3	
	nulla	4	
Naturale (Vn)	alta	0,25	
	media	0,5	
	bassa	0,75	
	nulla	1	
Totale			
Valore % (max punteggio 5=100%)			

* per le ricerche passate presenti e future

** attualmente vale solo come stima, verrà computato quando il parametro sarà disponibile per tutti i geositi al termine della ricerca bibliografica

* ** vale solo come stima in quanto per Vr e Lc non sono disponibili dati certi per tutti i geositi

*** verificare meglio (regole, asuc, ecc.)

**** il valore ecologico, attualmente non quantificabile in modo obiettivo e definitivo, non incide nella determinazione dle valore aggiunto

C.3 Geosites in the Adamello Brenta Geopark: a summary table

This chapter consists of a summary table that compares 61 geosites, listed according to the total score in decreasing order.

Assessment and description cards (annex 3) have also been compiled for each geosite. Each card contains the following items:

- geosite name and a brief geological description
- assessment: provides indications about the critical issues and potential opportunities of the geosite, based on an analysis of the Scientific Value, Use and Vulnerability scores. It gives an indication on the accessibility (types and difficulties of paths as well as travelling times according to CAI-SAT standards), on the present "exploitation" state (environmental tourism, research, education etc.) and on the geological vulnerability and protection procedures
- Chorography
- Geosite assessment card.

Annex 4 shows a table summarising all of the geosites in excel format.

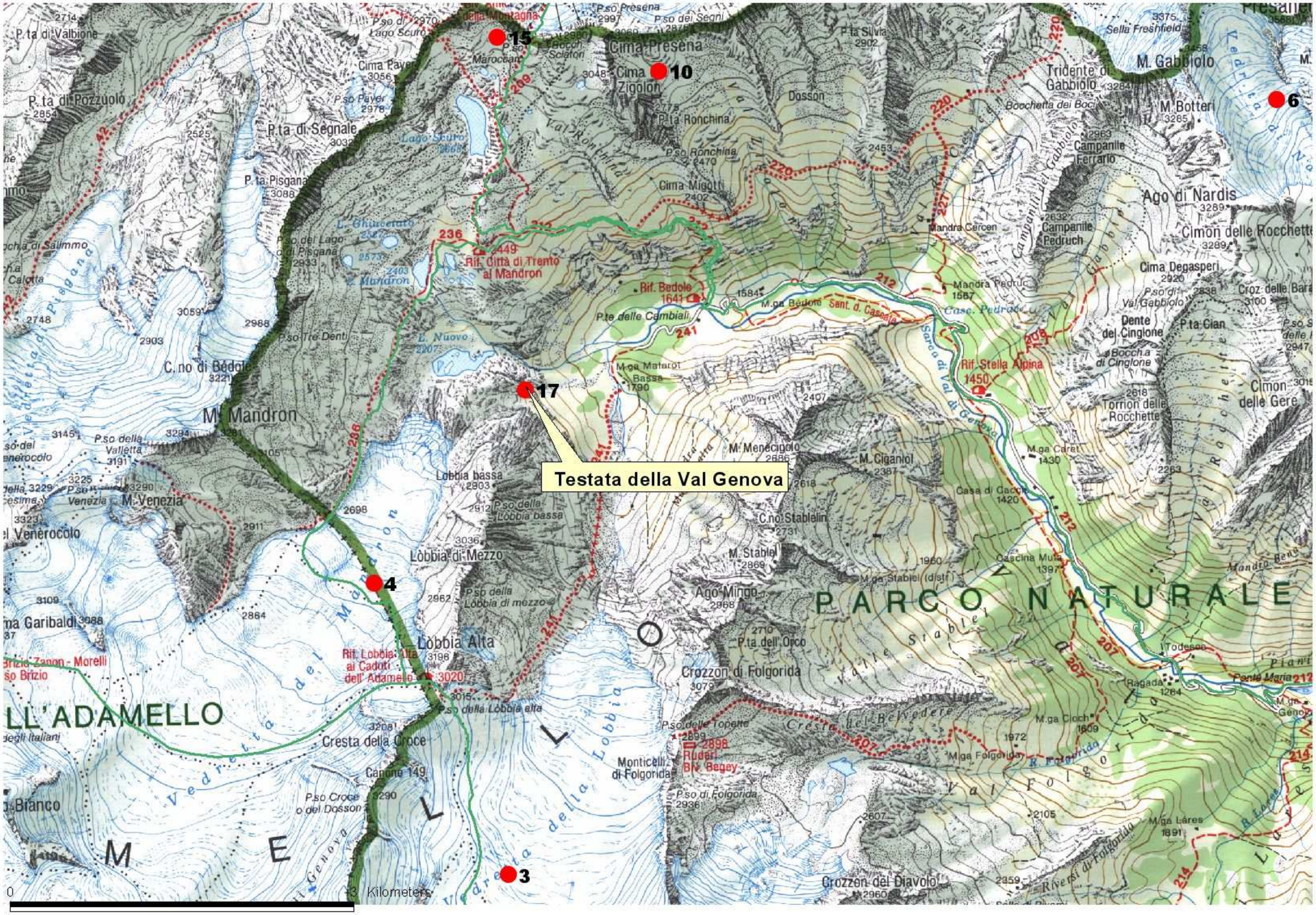
An example of the assessment of the Geosite n.17 (extracted from annex 3) is shown below.

17-Head of Val Genova: glacial valley, whose head retains some of the clearest morphological evidence related to the evolution of the Lobbia and Mandrone glaciers. These glaciers are the two principal glacial masses in the Geopark. An analysis of these morphological characteristics makes it possible to reconstruct the recent geological history of this environment.

Assessment: site with high scientific value and high use index. It represents one of the most visited areas in the Park and is therefore subject to the control of the number of tourists (Sustainable mobility project of Valle di Genova). Apart from expert hikers and alpinists, it is the last outpost in the valley accessible to the average tourist. The Matarot area is part of a reserved area, which is: Integral a little above Matarot, Guided B3 (below the Alpine hut), Guided B4b in the surrounding pastures
Main access: from Piana di Bedole (1585 m), by shuttle bus or, in limited controlled periods, by car; then by foot along route SAT 212(E) to reach the Bedole Refuge (1641 m); after the refuge, path SAT 241(E) is taken towards the Matarot Alpine hut. The time to reach Conca di Matarot, the furthest point in the head of the valley, is approximately 120 minutes.
The site is suitable for multidisciplinary educational and training activities, as well as cultural and promotional projects, on geological-environmental topics.
Visits to the site are along well marked trails, so deterioration of the paths is minimised. The individual elements of the goesite (moraines, sheep-back rocks, gorges) are not easily damaged; therefore the presence of visitors outside of the trails will not damage the site. On some specific morphological units (moraines) on which detailed studies are conducted, it is advisable to preserve the high trunk vegetation, used in specific of research projects.

Actions: development of the geotouristic project “To the discovery of the Glacier which used to be”, started in summer 2005. Information guides to accompany – ref C.4 1.3 “Rifugi e dintorni” – ref. C.4 1.4, connections with CETS (European Charter for Sustainable Tourism) actions - 1.1 - 1.5 – 1.6 - 1.9 - 1.10 - 4.26 - 4.27 - 4.31 (To the discovery of the Glacier which used to be) - 4.35 - 5.44.

Interventions: 2008-2009.


Testata della Val Genova
15
10
6
17
4
3
0
3 Kilometers
Cima Presena
Cima Zigolon
P.so Presena
P.so dei Segni
Cima Payer
P.so Payer
P.ta di Valbione
P.ta di Pozzuolo
P.ta di Segnale
P.ta Pisgana
Lago Scuro
L. Ghiacciato
L. Mandron
L. Nuovo
Rif. Città di Trento al Mandron
Rif. Bedole
P.te delle Cambiali
M.ga Matarot Bassa
P.ta Ronchina
P.so Ronchina
Cima Migotti
Dosson
P.ta Silvia
Tridente di Gabbiolo
M. Gabbiolo
M. Botteri
Bocchetta dei Boci
Campanile Ferrario
Ago di Nardis
Cimon delle Rocchette
Campanile Pedruch
Mandra Cercen
Mandra Pedruc
Cima Degasperi
Croz delle Bare
Dente del Cinglone
P.ta Cian
Bocca di Cinglone
Torrion delle Rocchette
Cimon delle Gere
Rif. Stella Alpina
M.ga Bedole
Sent. d. Casette
Casc. Pedrotti
Sarca di Val di Genova
M. Mandron
P.so della Valletta
M. Venezia
C.no di Bedole
P.so Tre Denti
Lobbia bassa
P.so della Lobbia bassa
Lobbia di Mezzo
P.so della Lobbia di mezzo
Lobbia Alta
Rif. Lobbia Alta ai Caduti dell' Adamello
P.so della Lobbia alta
Cresta della Croce
Cannone 149
P.so Croce o del Dosson
M. Menecigolo
M. Ciganiol
C.no Stablelin
M. Stablel
Ago Mingo
P.ta dell' Orco
Crozzon di Folgorida
Cresta del Belvedere
P.so delle Topette
Ruderi Biv. Begey
Monticelli di Folgorida
P.so di Folgorida
Crozzon del Diavolo
Vedretta della Lobbia
Vedretta del Mandron
Valle Stablel
Val Folgorida
M.ga Folgorida
M.ga Cloch
M.ga Lares
M.ga Caret
Casa di Caccia
Cascina Muta
Ragada
Todesca
Ponte Maria
PARCO NATURALE
ADAMELLO
LL'ADAMELLO
Rif. Brizio Zanon - Morelli
P.so Brizio
Vedretta del Pisgana
Venerocolo

Valore Scientifico			valore
Integrità	cattivo	1	3
	discreto	2	
	buono	3	
	ottimo	4	
Rappresentatività	nessuna	0	4
	bassa	1	
	media	2	
	alta	3	
	altissima	4	
Rarità	>7	0	4
	5-7	1	
	3-4	2	
	1-2	3	
	unico	4	
Valore paelogeografico	basso	1	4
	moderato	2	
	alto	3	
	molto alto	4	
Esemplarità didattica	bassa	0	4
	media	2	
	alta	4	
Diversità elementi di interesse (geomorfo., stratigr., paleont., ecc.)	1 elemento	0	2
	1< elementi < 3	2	
	3 > elementi	4	
Valore per la ricerca*	basso	1	4
	medio	2	
	alto	3	
	molto alto	4	
Livello conoscenza**	nullo	0	2
	note e articoli in giornali locali e regionali	1	
	1 tesi laurea 1 articolo scientifico nazionale	2	
	1 tesi phD, articoli scientifici naz/internaz	3	
	> 1 tesi phD, articoli scient. naz/internaz	4	
Totale			21
Totale * **			27
Valore % (max punteggio 32=100%)			84,375

Fruibilità			valore
Visibilità	difficoltosa	1	3
	limitata	2	
	buona	3	
	eccellente	4	
Modalità di raggiungimento	piedi	0,75	0,75
	bicicletta	1,50	
	bus-auto moto-imp. Ris	2,5	
Accessibilità	EEA	1	3
	EE	2	
	E	3	
	T	4	
Tempo raggiungimento geosito a piedi	>240 min	1	3
	120-240 min	2	
	30-120 min	3	
	0-30 min	4	
Tempo raggiungimento centri di servizio a piedi	>240 min	1	4
	120-240 min	2	
	30-120 min	3	
	0-30 min	4	
Intensità d'uso attuale	bassa	0	2
	media	2	
	alta	4	
Intensità d'uso potenziale	bassa	0	4
	media	2	
	alta	4	
Attività che possono essere svolte (scientifica, edu, turistica, divulg.)	1 attività	0	4
	2 attività	2	
	attività >=3	4	
Proprietà bene***	privato	0,25	0,50
	pubblico	0,50	
Totale			24,25
Valore % (max punteggio 31=100%)			78,23

Valore Aggiunto****			valore
Ecologico	basso	0	
	medio	2	
	alto	4	
Spettacolarità	bassa	1	3
	alta	3	
Culturale: religiosa, storico-archeologiaca, artistico-letteraria, geostorica, iconografica	nessuno	0	2
	1	1	
	2	2	
	3	3	
	>3	4	
Presenza di elementi di richiamo (rifugi, malghe, ristoranti, agriturismo, pesca sportiva, ecc.)	no	0	2
	si 1	2	
	si >1	4	
Totale			7
Valore % (max punteggio 11=100%)			63,64

Tutela		valore
PNAB	1	1
PUP	0,5	
Totale		1

Vulnerabilità			valore
Antropica (Va)	alta	1	
	media	2	
	bassa	3	3
	nulla	4	
Naturale (Vn)	alta	0,25	
	media	0,5	
	bassa	0,75	
	nulla	1	1
Totale			4
Valore % (max punteggio 5=100%)			80,00

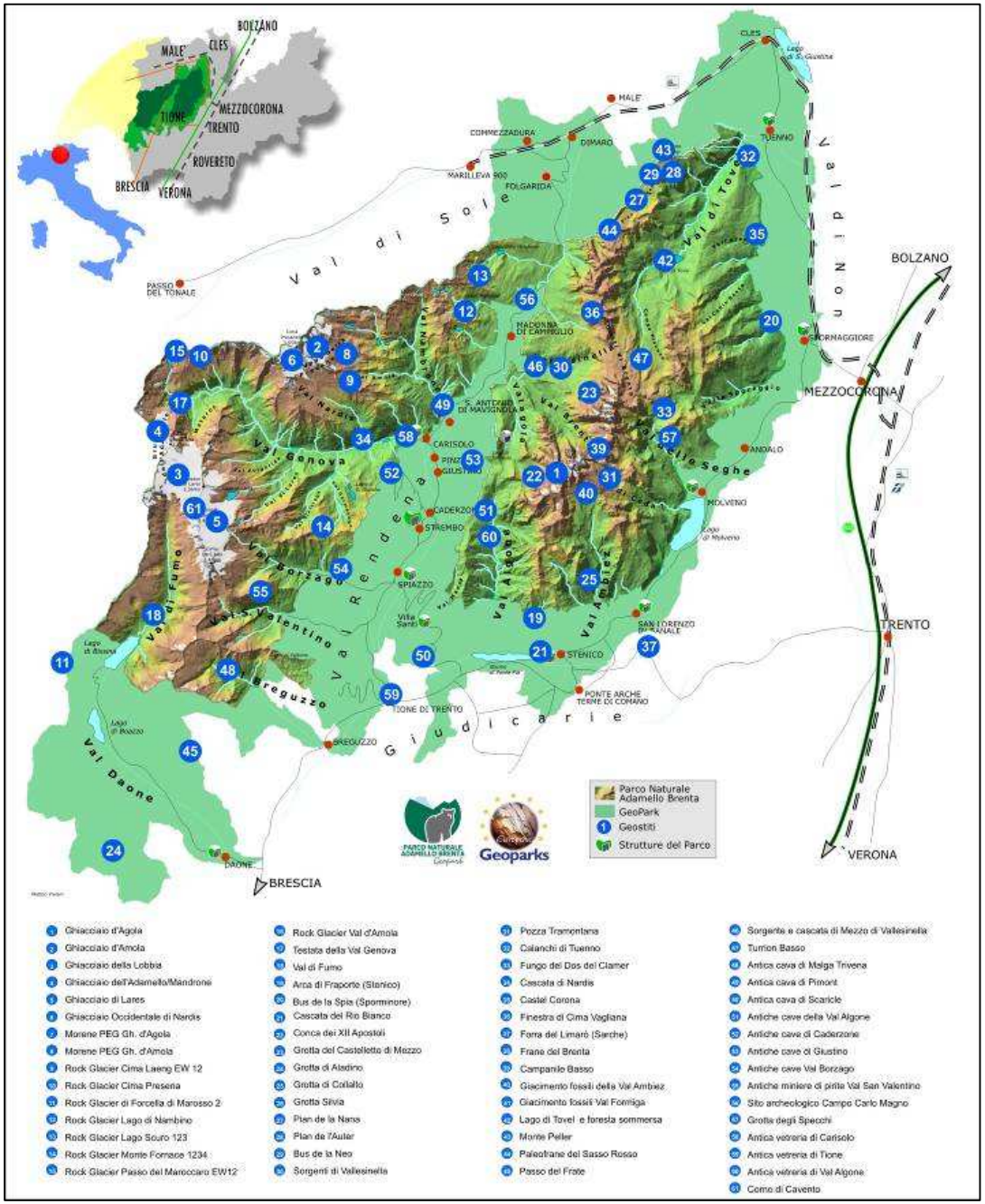
* per le ricerche passate presenti e future

** attualmente vale solo come stima, verrà computato quando il parametro sarà disponibile per tutti i geositi al termine della ricerca bibliografica

* ** vale solo come stima in quanto per Vr e Lc non sono disponibili dati certi per tutti i geositi

*** verificare meglio (regole, asuc, ecc.)

**** il valore ecologico, attualmente non quantificabile in modo obiettivo e definitivo, non incide nella determinazione dle valore aggiunto



Map of the 61 ABG Geosites

ABG GEOSITES				ASSESSMENT					
Legend: CLASS 0: GLACIERS - CLASS 1: GLACIAL AND PERIGLACIAL MORPHOLOGIES - CLASS 2: KARST MORPHOLOGIES - CLASS 3: SITES WITH GEOLOGICAL VALUE - CLASS 4: SITES WITH DEMO-ETHNO-ANTHROPOLOGIC VALUE									
N°	NAME	DESCRIPTION	CLASS	Scientific Value	Use	Added Value	Vulnerability	Total	Protection
42	**Tovel Lake and submerged forest**	Lake formed as a result of a landslide that eventually submerged a forest which is still preserved	**3**	**27,00**	**29,00**	**9,00**	**5,00**	**70,00**	**1,00**
31	**Vallesinella Springs**	Group of karst springs that gave rise to the Vallesinella high waterfalls.	**2**	**26,00**	**26,75**	**6,00**	**3,75**	**62,50**	**1,00**
17	**Head of Val Genova**	Glacial valley whose head retains some of the clearest morphological evidence related to the evolution of the Lobbia and Mandrone glaciers. These glaciers are the two principal glacial masses in the Geopark. An analysis of these morphological characteristics makes it possible to reconstruct the recent geological history of this environment.	**1**	**27,00**	**24,25**	**7,00**	**4,00**	**62,25**	**1,00**
21	**Rio Bianco Waterfall**	Waterfall fed by a karst spring from a rock fracture.	**2**	**19,00**	**27,00**	**8,00**	**4,75**	**58,75**	**0,50**
22	**XII Apostoli Basin**	Glacial-karst basin, with evidence of superficial karst forms along with recent glacial deposits which belong to the Little Ice Age (LIA).	**2**	**25,00**	**21,25**	**7,00**	**4,00**	**57,25**	**1,00**
18	**Val di Fumo**	Classic example of a glacial valley with a typical parabola shape, linear profile with clear evidence of shoulders shaped in the rock.	**1**	**22,00**	**22,00**	**8,00**	**5,00**	**57,00**	**1,00**
58	**Old Glass factory of Carisolo**	Old crystal factory, well preserved industrial archeological site, evidence of the thriving glass trade in Giudicarie and Val Rendena during the 800s.	**4**	**18,00**	**27,00**	**7,00**	**5,00**	**57,00**	**0,50**
27	**Pian de la Nana**	Glacial-karst basin with evidence of superficial karst features (karren, shower furrows, karst crevasses, sinkholes, sinkhole valleys) and glacial shaping.	**2**	**24,00**	**22,00**	**5,00**	**4,00**	**55,00**	**1,00**
34	**Nardis Waterfall**	Spectacular waterfall that links a suspended lateral valley with the main one, fed by melting snow water from Vedretta di Nardis.	**3**	**15,00**	**29,00**	**6,00**	**4,75**	**54,75**	**1,00**
4	**Adamello/Mandrone Glacier**	Overall, it is the largest glacier in the Italian Alps and is the principal element of the glacier system in the central sector of the Adamello.	**0**	**26,00**	**17,25**	**8,00**	**2,50**	**53,75**	**1,00**
43	**Mount Peller Cirque**	Well preserved and shaped small glacial cirque.	**3**	**21,00**	**23,00**	**5,00**	**4,00**	**53,00**	**0,50**
41	**Val Formiga Fossil deposit**	Rich fossil deposits located at an approximate altitude of 1900 m, at the head of Val Formiga, a small lateral valley of the Pian della Nana glacial karst basin. It represents a rich fauna of brachiopods and cephalopods related to lower Toarcian-Aalen, some of which are typical of the Brenta Massif, such as Rhynchonella Pelleria.	**3**	**25,00**	**19,00**	**4,00**	**4,00**	**52,00**	**1,00**
28	**Plan de l'Auter**	Large glacial-karst basin with evidence of superficial karst features.	**2**	**20,00**	**22,00**	**5,00**	**4,00**	**51,00**	**1,00**

ABG GEOSITES				EVALUATION					
Legend: CLASS 0: GLACIERS - CLASS 1: GLACIAL AND PERIGLACIAL MORPHOLOGIES - CLASS 2: KARST MORPHOLOGIES - CLASS 3: SITES WITH GEOLOGICAL VALUE - CLASS 4: SITES WITH DEMO-ETHNO-ANTHROPOLOGIC VALUE									
N°	NAME	DESCRIPTION	CLASS	Scientific Value	Use	Added Value	Vulnerability	Total	Protection
47	**Turrion Basso**	Isolated tapered rock, of structural origin and shaped by glacial action in the Zu Formation's marly limestone.	**3**	**22,00**	**19,00**	**5,00**	**5,00**	**51,00**	**1,00**
46	**Mezzo di Vallesinella spring and waterfalls**	Group of karst springs, sometimes with remarkable flow rate, which give rise to a series of waterfalls. Of notable interest is the karst system which drains much of the central-western Brenta. The water emerges at layer boundaries.	**3**	**14,00**	**26,00**	**6,00**	**4,75**	**50,75**	**1,00**
44	**Sasso Rosso paleo-landslides**	Extraordinary and well exposed example of detachment niches and deposits of large upper Cretacic paleolandslides, which are "fossilised" in the limestone-silicoclastic sedimentary sequence.	**3**	**26,00**	**14,25**	**5,00**	**5,00**	**50,25**	**1,00**
45	**Passo del Frate**	Rocky pinnacle about 20 m tall, located in Passo del Frate (Val Breguzzo), carved in metamorphic limestone. The rocks are crossed by heavily eroded volcanic dykes. First World War trenches were dug in lines which matched the dykes.	**3**	**23,00**	**17,25**	**6,00**	**4,00**	**50,25**	**1,00**
15	**Passo del Maroccaro EW12 Rock Glaciers**	Active lobate rock glaciers with tongue shape, located on the SW side of upper Val Genova, below the Maroccaro Pass. Evidence of morphological features: depressed body, steep front slope and swollen tongue.	**1**	**22,00**	**16,25**	**7,00**	**4,75**	**50,00**	**1,00**
16	**Val d'Amola Rock Glacier**	Active rock glacier located on the right side of the Amola Valley. It consists of a single inflated debris flow, with *debris flow* events on the frontal slope. Particularly easy to observe.	**1**	**22,00**	**18,25**	**5,00**	**4,75**	**50,00**	**1,00**
19	**Arca di Fraporte**	Very high karst cave, characterised by a natural bridge	**2**	**22,00**	**16,25**	**6,00**	**5,00**	**49,25**	**0,50**
39	**Campanile Basso**	Dolomitic monolith approximately 250 m tall, typical example of morphostructural evolution and very popular among alpinists.	**3**	**19,00**	**18,25**	**7,00**	**5,00**	**49,25**	**1,00**
37	**Limarò Gorge**	A series of spectacular torrential gorges of different width depending on the lithotypes. The gorges are located between Comano Terme and Sarche. Locally known as Limarò Gorge and Ponte Pià.	**3**	**20,00**	**19,00**	**6,00**	**4,00**	**49,00**	**0,50**
32	**Tuenno Gullies**	Erosional gullies in marly terrains. Rare and unusual phenomenon in this area.	**3**	**20,00**	**21,00**	**3,00**	**4,00**	**48,00**	**0,50**
2	**Amola Glacier**	Nice example of a "black glacier": 2/3 of its surface is covered by a layer of debris which in some places is 1 metre tick. This feature, not only slows down the melting process, but also allows the formation of typical "ice mushrooms": big boulders held up by a thin ice stalk.	**0**	**22,00**	**18,25**	**3,00**	**4,50**	**47,75**	**1,00**
40	**Val d'Ambiez Fossil deposit**	Outcrop located north-west of Cacciatori Refuge in upper Val d'Ambiez. Very rich deposit of Megalodon bivalves, sometimes of remarkable dimensions, enhanced by erosion.	**3**	**17,00**	**20,25**	**5,00**	**4,00**	**46,25**	**1,00**

ABG GEOSITES				ASSESSMENT					
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N°	NAME	DESCRIPTION	CLASS	Scientific Value	Use	Added Value	Vulnerability	Total	Protection
20	**Bus de la Spia**	Karst cave hydraulically active: it partially empties at regular intervals. The system is linked to the near Acquasanta spring and it follows the same flow pattern.	**2**	**23,00**	**15,00**	**4,00**	**4,00**	**46,00**	**0,50**
29	**Bus de la Neo**	Large karst cave.	**2**	**17,00**	**20,00**	**5,00**	**4,00**	**46,00**	**1,00**
60	**Val Algone old glass factories**	Old crystal factories, well preserved industrial archeological site, evidence of the thriving glass trade in Giudicarie and Val Rendena during the 800s.	**4**	**16,00**	**20,00**	**6,00**	**4,00**	**46,00**	**1,00**
12	**Nambino Lake's Rock Glacier**	Non active rock glacier located on the north-facing slope, near Nambino Lake, in the Adamello Group. Clearly visible sinuous lines, curved lines, developed tongue, depressed body and funnel-shaped cavities.	**1**	**18,00**	**19,25**	**3,00**	**5,00**	**45,25**	**1,00**
9	**Cima Laeng Rock Glaciers**	Tongue shaped active rock glaciers, located at an altitude of 2400 m in the cirque in the north of Cima Laeng, Adamello Group. Curved lines, steep front slope and developed tongue.	**1**	**20,00**	**17,25**	**3,00**	**4,75**	**45,00**	**1,00**
26	**Silvia Cave**	Cave characterised by hypogean ice deposits.	**2**	**24,00**	**11,25**	**5,00**	**4,00**	**44,25**	**1,00**
30	**Pozza Tramontana**	Large glacial-karst basin, closed on all sides.	**2**	**21,00**	**14,25**	**5,00**	**4,00**	**44,25**	**1,00**
1	**Agola Glacier**	Small cirque glacier, approximately 22 ha, it represents a typical glacier of the Brenta Group.	**0**	**19,00**	**17,25**	**3,00**	**3,50**	**42,75**	**1,00**
56	**Campo Carlo Magno Archeological Site**	Site located at an approximately altitude of 1600 m, between Campo Carlo Magno and Mondifrà alpine huts, where recent Mesolithic finds were discovered.	**4**	**17,00**	**16,00**	**4,00**	**5,00**	**42,00**	**1,00**
23	**Castelletto di Mezzo Cave**	Well explored cave (> 1000 m) with hypogean ice deposits.	**2**	**24,00**	**9,25**	**5,00**	**2,75**	**41,00**	**1,00**
48	**Malga Trivena old quarry**	Old ornamental stone quarry from which Breguzzo marble was extracted. It is a contact marble, the origin of which is related to the strong thermic alteration induced during the intrusion of the Adamello batholith within limestone.	**4**	**15,00**	**17,00**	**4,00**	**5,00**	**41,00**	**1,00**
3	**Lobbia Glacier**	"plateau" glacier with lateral tongues, characterised by a flat central sector from which two valley-type tongues branch off. The larger tongue flows towards Val Genova in the north, while the smaller one flows towards Val di Fumo in the south.	**0**	**21,00**	**10,25**	**6,00**	**3,50**	**40,75**	**1,00**
8	**LIA moraines of the Amola Glacier**	Sharp moraine banks located on the sides of the Amola Glacier. They are evidence of the dimension and position taken by the glacier during the Little Ice Age.	**1**	**15,00**	**17,25**	**5,00**	**3,00**	**40,25**	**1,00**

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N°	NAME	DESCRIPTION	CLASS	Scientific Value	Use	Added Value	Vulnerability	Total	Protection
35	**Castel Corona**	Large rocky natural niche shaped in a vertical wall within which is located a XII century fort.	**3**	**15,00**	**16,25**	**4,00**	**5,00**	**40,25**	**0,50**
7	**LIA moraines of the Agola Glacier**	Typical LIA moraines, sharp and particularly well preserved.	**1**	**14,00**	**17,25**	**5,00**	**3,00**	**39,25**	**1,00**
59	**Od Glass factory of Tione**	Old crystal factory, well preserved industrial archeological site, evidence of the thriving glass trade in Giudicarie and Val Rendena during the 800s.	**4**	**12,00**	**20,00**	**2,00**	**5,00**	**39,00**	**0,50**
13	**Lago Scuro 123 Rock Glacier**	Two types of non-active rock glaciers: tongue shape (2-3) and lobate (1). 2-3 are located at the base of the slope, while 1 is at the bottom of the valley, next to Lago Scuro (Presanella Group). Clear morphological characteristics: curved lines, steep front slope, funnel-shaped cavities and developed tongue.	**1**	**18,00**	**12,25**	**3,00**	**5,00**	**38,25**	**1,00**
57	**Conca dei Lasteri Grotta dello Specchio**	Glacial-karst basin of about 2 km^2, located in the central-eastern sector of the Brenta Group. Characteristic superficial karst morphologies and presence of three large hypogean caves. One of the caves, the Grotta dello Specchio (Mirror Cave), contains neotectonics and fossilised ice deposits.	**2**	**24,00**	**9,25**	**1,00**	**4,00**	**38,25**	**1,00**
38	**Brenta Landslide**	Large landslide deposits, generally with large limestone boulders. They occupy large portions of the slope next to the path linking the Tuckett and Brentei refuges.	**3**	**16,00**	**11,25**	**5,00**	**5,00**	**37,25**	**1,00**
14	**Monte Fornace 1234 Rock Glacier**	Two types of non-active rock glaciers, lobate e tongue-shaped, located on the NE slope of Fornace Mount. Evidence of morphological features: curved lines, sinuous lines, steep front slope, swollen tongue, funnel-shaped cavities.	**1**	**18,00**	**10,25**	**3,00**	**5,00**	**36,25**	**1,00**
33	**Fungo del Dos del Clamer**	Small rocky mushroom, originated from morpho-selection in very fractured limestone.	**3**	**16,00**	**13,25**	**3,00**	**4,00**	**36,25**	**1,00**
10	**Cima Presena Rock Glacier**	Complex tongue shaped rock glacier, located in the cirque on the SW side of Cima Presena. Evidence of morphological features: sinuous lines, steep front slope, developed and swollen tongue.	**1**	**23,00**	**7,25**	**1,00**	**4,75**	**36,00**	**1,00**
49	**Pimont Old Quarry**	Old ornamental stone quarry, from which the Adamello tonalite was extracted. The stone was largely used in traditional buildings of the Rendena Valley.	**4**	**12,00**	**17,00**	**2,00**	**5,00**	**36,00**	**1,00**
24	**Aladino Cave**	Large cave (> 7000 m), in the limestone metamorphosed by the Adamello batholith.	**2**	**19,00**	**9,25**	**3,00**	**4,00**	**35,25**	**0,50**
25	**Collalto Cave**	Large cave (> 5000 m) with large cavities (rooms).	**2**	**18,00**	**9,25**	**5,00**	**3,00**	**35,25**	**1,00**

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N°	NAME	DESCRIPTION	CLASS	Scientific Value	Usability	Added Value	Vulnerability	Total	Protection
36	**Finestra di Cima Vagliana**	Large natural arch located on the eastern side of Cima Vagliana, carved in the Calcari Grigi (Grey Limestone Formation) and formed by selective erosion.	**3**	**17,00**	**10,25**	**3,00**	**4,75**	**35,00**	**1,00**
11	**Forcella di Marosso 2 Rock Glacier**	Non-active tongue shape rock glacier, located in the cirque on the SE side of Marosso Mount. Evidence of morphological features: steep front slope and swollen tongue.	**1**	**18,00**	**9,25**	**1,00**	**5,00**	**33,25**	**1,00**
51	**Val Algone old caves**	Old quartz caves from which the mineral was extracted.	**4**	**10,00**	**12,00**	**6,00**	**5,00**	**33,00**	**1,00**
52	**Caderzone old caves**	Old quartz caves from which the mineral was extracted for the use in the Giudicarie glass factories during the 800s.	**4**	**10,00**	**14,00**	**4,00**	**5,00**	**33,00**	**1,00**
6	**Nardis Western Glacier**	Second largest glacier of the Presanella Group, located at the head of the Nardis Valley, in the large cirque on the SE side, bordered by Cima Presanella and Cima Vermiglio. The melting waters feed the Nardis Waterfalls.	**0**	**18,00**	**8,25**	**3,00**	**3,50**	**32,75**	**1,00**
50	**Scaricle old quarry**	Old ornamental stone quarry, from which the Nero di Ragoli was extracted. It is a uniform black stone largely used in the decoration of churches and palaces.	**4**	**12,00**	**13,25**	**2,00**	**5,00**	**32,25**	**1,00**
55	**San Valentino Valley old pyrite mines**	Old pyrite and chalcopyrite (Zn, Pb) mines. They are an indication of the importance of mining in the San Valentino Valley.	**4**	**12,00**	**11,25**	**4,00**	**5,00**	**32,25**	**1,00**
61	**Corno di Cavento**	A 3402 m high summit in the Adamello Group, important Austro-Hungarian fortress during the First World War and captured by the Italian army in 1917.	**4**	**14,00**	**8,25**	**4,00**	**5,00**	**31,25**	**1,00**
54	**Val Borzago old caves**	Old quartz caves from which the mineral was extracted for glass production.	**4**	**10,00**	**14,00**	**2,00**	**5,00**	**31,00**	**1,00**
53	**Giustino old caves**	Old quartz caves from which the mineral was extracted for glass production.	**4**	**10,00**	**12,00**	**2,00**	**5,00**	**29,00**	**1,00**
5	**Lares Glacier**	Third largest glacier in the Adamello Group. It occupies the wide large side of the valley and is bordered by the Caré Alto-Crozzon di Lares ridge. Its surface is rather smooth with some crevasse areas. The front slope is divided into two lobes by a rocky ridge and flows down to an altitude of about 2600 m.	**0**	**13,00**	**8,25**	**1,00**	**3,50**	**25,75**	**1,00**

D SURVEY OF GEOPARKS AND EXISTING GEOSTRUCTURES

The Adamello Brenta Geopark regulations introduce a modern idea of protection: beyond the conservation of the natural heritage, they promote social use and scientific research. Therefore, the Park's main aims of active protection and conservation of the territory and environmental assets are part of a broader strategy aimed at the promotion and use of the natural heritage, together with the promotion of environmental education.

The Park has already implemented actions targeted at the promotion of the geological-geomorphological heritage and, more generally, at the natural and historical-cultural environment. Tourism and educational programmes for schools have also been developed.

With reference to the three main areas defined in chapter B, the main ABG actions and structures that have a bearing on geology, are described in the following section.

D.1 Interpretation

D.1.1 Structures

<u>Geotourism trails</u>

- Eight natural routes or special paths with information panels which illustrate the landscape and its natural, historical and cultural characteristics, together with geological-geomorphological aspects. The information can be integrated with guidebooks or brochures.
- According to the guidelines of the Environmental Analysis Plan (PIA), the "natural trails" are defined with specific educational aims and are characterised by several information aids (panels, dioramas, guidebooks etc.), generally located next to the Visitor Centres. The definition of the "Park's special paths" instead, is based on excursion-leisure goals and they do not need information aids along the trail. There are generally one or two in each valley and are characterised by their scenic, environmental and natural value.
    - Val di Tovel: Glare special path, with 8 panels in total, five of which are dedicated to geological topics such as "Geological history of the Glare", "Reading the landscape (geomorphology)", "The landslide", "The calchera (kiln)" and "The ephemeral ponds";
    - Val di Tovel: Lake Tovel natural trail, with 15 information panels scattered around the lake, eight of which cover geological themes such as "The characteristics of Lake Tovel", "The glacial deposits", "The karst", "The springs around the lake", "The lake's three phases", "The big rock's spring", "The waterfall" and "The Tresenga Stream".
    - Stenico: Rio Bianco natural trail, with 5 panels along the path to the Visitor Centre, which cover glaciers, the Brenta Group, Karst, Marmitte dei Giganti (potholes) erosion and formation processes and also valley formation;
    - Val d'Algone: Algone Valley natural trail, with 6 information panels, one of which is dedicated to the Park and Algone Valley's geographic environment and three to geological topics such as: "The Brenta Dolomites", "The abandoned quartz quarry" and "The old glass factory";

- Vallesinella: "Vallesinella Springs" natural trail, with 6 panels. The first is an introductory panel, while the others cover water-related themes: "The discovery of water sources", "The water cycle: from the mountains to the sea", "Sarca's spring", "A large water reservoir" and "Water springs, life springs";
- Head of Val Genova: Matarot special trail, with a panel at the start which illustrates the characteristics of a glacier. It is a circular trail that focuses on the glacial geomorphology and shows historical photographs of the glaciers at the head of the valley. The panel is situated in the same location to where the photographs were taken hence they allow an immediate comparison with the present dimensions of the glaciers;
- Val Nambrone: "AmolaWater" natural trail. The trail starts from an initial panel and follows a circular path in an enchanting landscape of streams, waterfalls and boulders. The trail highlights the effect water has on shaping the landscape. There are 7 interesting stops with geological explanations of the environment: glacial valleys, hydroelectric exploitation, glacial silt, glacial and clastic deposits, origin of the Park's rocks, water's controlling action, fluvial erosion;

Panel at the beginning of the natural trail "AmolaWater"

- N. 1 self-guided trail in Val d'Ambiez, accompanied by an illustrative folding brochure and organised into several stops – "Men and rocks" -, dedicated to the geology and geomorphology of the valley and how it influenced man's traditions in the area. The 5 stops are: "Fossils cemetery", "Genesis of a mountain", "Glacial deposits of Malga Ben", "Calchera (kiln)" and "V-shaped and U-shaped valleys".

A careful maintenance and marking programme for the paths and forest roads is also performed in the Park's territory. The total network covers more than 900 km, in addition there are numerous cycling routes, which cover almost the whole territory, allowing an appreciation of the natural features, especially the geological and geomorphological ones. Moreover, in 2008 the inaugural event of "Dolomiti di Brenta Bike" took place. It has two separate mountain bike tours around the Brenta Dolomites, which accommodate both experts and novices (suitable for families).

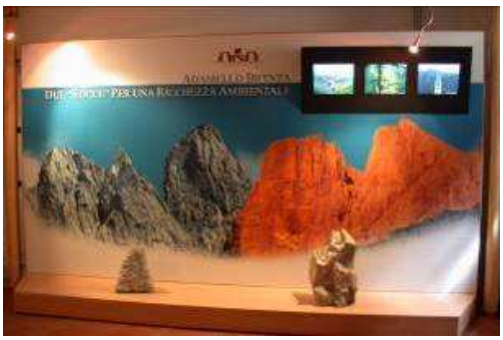
Visitor Centres, InfoPark and other structures

- S. Antonio of Mavignola Information point and guesthouse. There are two panels which introduce the Park's geology and two tonalite and dolomite boulders in the small garden. The guesthouse is similar to the one next to Malga Valagola at an altitude of 1600 m and can accommodate up to 24 people. The Malga Stabli guesthouse in Val d'Algone instead, can accommodate 50 people. This guesthouse is especially suitable for students who wish to experience nature directly and can be encouraged to learn, respect and protect the environment;
- five Visitor Centres, dedicated to specific themes and used for educational activities. Inside each centre, a small geology area has been reserved, specifically:
  - Visitor Centre "Flora", Stenico: a plastic model, with the aid of a film, reproduces the origin of the Park's limestone. The panel mainly covers the rich biodiversity of the Park, with indirect references to geology;
  - Visitor Centre "Red Lake" Tovel: a plastic model shows water infiltration and subsequent re-emergence in a karst environment. A panel illustrates the limestone's characteristics;
  - Visitor Centre "Fauna", Daone: three panels illustrate the two main rocks to be found in the Park (Tonalite and Dolomite) as well as the physical and aquatic environments. A glass cabinet contains fossil samples;



Panels in "Fauna" Visitor Centre of Daone, which illustrate geological topics

  - Visitor Centre "Bear", Spormaggiore: two panels at the entrance are dedicated to the Park's physical environment and its two main rocks; rock samples are also on display;


Panels in the "Bear" Visitor Centre of Spormaggiore

- Visitor Centre "Once upon a time", San Lorenzo in Banale: covers ancient crafts which are related to the geology of the area. There are no direct references to geological features;

- Research Centre "Adamello – Julius Payer": it was built in 1994 by the SAT (Tridentine Alpinists Society) in partnership with the Tridentine Museum of Natural Sciences and renovated in 2004 in partnership with the Adamello Brenta Natural Park. It is dedicated to the memory of the Austrian officer who first climbed Adamello (15 September 1864). The Centre is located in the restored Mandrone Refuge, which was built in 1878 by the Leipzig branch of D.Oe.A.V. and is one of the oldest huts in Trentino. The main aim of the Centre is to increase our knowledge of glaciers and high mountain environments, promoting research in different disciplines. It is also a logistics base for learning and training courses. The nearby refuge "Città di Trento" offers excellent logistical support for long-term courses;
- Limnological station of the Tridentine Museum of Natural Sciences at Lake Tovel. The two storey building is dedicated to geological and biological sciences. It includes a central hall for microscopy, a chemical laboratory and a small kitchen, which can be used by researchers and universities for summer schools or courses. They can be organised independently or with technical and scientific support from the Museum's researchers.

D.1.2 Communication

Advertisement

- The Park's information material illustrates the main characteristics of valleys and the territory; it also contains a description of the geological and geomorphological features of the area as well as information on the network of paths:

  - Park guidebook (Park guidebook series);
  - Adamello Brenta Park (Park's quarterly magazine);
  - Presentation Brochure (also available in English);
  - "Valleys in the Park" brochure;
  - Val d'Algone guidebook "The valley of glass and alpine huts" (Percorsi series);
  - Volume: "The lakes of the Adamello Brenta Park" (Park Documents series);
  - Volume: "The springs of the Adamello Brenta Park" (Park Documents series);
  - Volume: "The glaciers of the Adamello Brenta Park" (Park Documents series);
  - DVD "Tovel Valley";
- Some publications are specifically related to geology:
  - Self-guided trail "Val d'Ambiez" brochure;
  - Guidebook "Vallesinella water and suggestive rocks" (Percorsi series) available on the Park's website;
  - Series of 8 handbooks on learning activities in the Tovel Valley, two of which are specifically dedicated to the Tovel Valley and Lake's geology.

D.1.3 Activities

Teaching-Educational Area

Schools

- Two environmental education projects have been proposed to primary and secondary schools in the Geopark's territory. They aim is to develop a knowledge of rocks and their origin as well as that of the rich Geodiversity of the area. In more detail:
  - Primary School: "The Park's rocks and minerals". Students learn about minerals and rocks through experiments, samples and games. A trip to areas near to the school will teach the students how to recognise the main rocks in their territory and they will realise artistic works with river sand and soils;
  - Secondary School first grade: "The Park's Geology". The project focuses on the Earth Sciences and is divided into three stages: the first is an introductory lecture held in the classroom that focuses on an explanation of geological time; the second is a trip with exercises in geological surveys, as well as rock identification and classification; the third stage is a final meeting in the classroom, where the characteristics of the observed samples are studied in more detail and a geological map is also realised. The students will learn to appreciate the rich Geodiversity of the ABG;
- One environmental education project aimed at primary schools in the Geopark's territory on the old glass factories "Tradition and culture: the glass factories". The project is divided into two classroom lectures and one trip. The students will learn about glass raw materials and the traditional working practises through learning aids, visits are organised to the old quartz quarries of Giustino and to the glass museum of the Carisolo Old Glass Factory. They will learn the importance of these early industries in the Park.

Permanent training

- At the end of summer 2007, as part of the 2007/2008 school year, a two day training course for teachers at Comprehensive Institutes (kindergarten, elementary and middle schools) and Higher Education establishments in the Geopark's area was organised. The course was held in the Valagola guesthouse and covered the theme "The Park's Geology". The course was organised in partnership with the Tridentine Museum of Natural Sciences, the Rovereto Civic Museum, the Provincial Agency for Environmental Protection and the SAT's Tridentine Glaciological Committee. The course was divided into the three main parts, followed by a guided excursion along the Head of Val Genova route "To the discovery of the glacier which used to be".
- In late summer 2008, as part of the 2008/2009 school year, the training course "Climate changes" was held at the Valagola and S. Antonio di Mavignola guesthouses.

Geotourism

Geotourism promotion and learning activities; which are characterised by guided tours devoted to analysing and understanding the geological and geomorphological landscape. The following guided tours take place on a weekly basis throughout the summer and include naturalistic, faunistic, botanic and historical-cultural themes:

- "Discovering of the Glacier that used to be", at the Head of Val Genova, in the heart of the Adamello Group. Captivating excursion to decipher the signs left by the glacier;
- "The springs of Vallesinella", all-day excursion to discover the hidden aspects of the Vallesinella waterfalls;
- "The quartz mines routes", trails from Doss del Sabbion, superb 360° views of the mountain ranges and across the Adamello Brenta Park. They follow the Val d'Algone and visit the old quartz quarries and Glass Factories;
- "The Glare trail geology", excursion hike across the stunning Glare lunar landscape, getting to know the "geological history" of Tovel Valley;

- Guided tour to the Adamello Study Centre "J Payer", with experts from the Tridentine Glaciological Committee of the Tridentine Alpinists Society;
- Activity aimed at children from 6 to 10: "From Mother Earth… the creative Geolaboratory", to observe and learn about the properties of the Earth and erosion. The children will use the river's sand to create art works;
- Proposed trial activity for summer 2008, two "Geotouristic" weeks within the project "Living in the Park". In partnership with the local Apt (Agency for Tourism) and the marketing society Trentino Spa, weekly holiday packages are proposed, with the aim of "Let nature take you on a holiday of discovery, silence, well-being and tradition; away from traffic, noise and pace, discover a friendly nature, relax and forget the car for a whole week."

D.2 Scientific Research

The Geopark has been and still is the subject of several scientific research projects. For more details, please consult the application's bibliography and the Park's website, where all the natural studies reported up until 2002 have been updated.

Past and present scientific studies are:

- Project in partnership with the Tridentine Glaciological Committee of SAT (Tridentine Alpinists Society) that addresses teaching, promotional activities and scientific research, in order to develop knowledge, conservation and promotion of the glaciers' resources;
- Scientific research projects in partnership with the Tridentine Museum of Natural Sciences.
- 1990-91: Cadastre of the Park glaciers (Tridentine Alpinists Society)
- 1996-99: Cadastre of the Park lakes (Tridentine Museum of Natural Sciences)
- 1996-99: Analysis of the Park's principal pedological features (Tridentine Museum of Natural Sciences)
- 1999-2002: Study of rock glaciers (Tridentine Alpinists Society's Glaciological Committee: profs. Baroni, Carton, Smraglia)
- 2004-2007: INHUMUS Project (Alpine Ecology Centre)

- 2006-2007: MURST Project (University of Pavia)
- 1992-93 (phase 1), 1996 (phase 2): survey and measurement of the Park's glaciers – Analysis and surveys on some of the main glaciers in the park (Tridentine Alpinists Society's Glaciological Committee)
- 1997: Study on the seasonal changes of the lakes Serodoli and Tre Laghi (Tridentine Museum of Natural Sciences)
- 1999-2001: Aspects of the Brenta Dolomites karst aquifer, with reference to the Vallesinella springs
- 2004-2007: Mass balance of the Agola glaciers (Tridentine Alpinists Society)
- 2004-2007: CRENODAT Project (MTSN)
- 2008 Publication of the Geological Map, scale 1:50,000 of M. Adamello. CARG Project, realised by the Geological Survey of the Autonomous Province of Trento (APT).

Activities not managed by the Park

Apart from services dedicated to naturalistic aspects, there are others, namely: history, culture and traditions, which give added value: Alpine hut Museum in the Caderzone Council; Solandra Civilisation Museum in the Malè Council; "From the Dolomites to the Lake Garda" Giudicarie Eco museum in the Condino Council; Adamello Alpine War Museum in the Spiazzo Council; Glass Museum in the Carisolo Council; S. Lorenzo historical village of the in Banale Council.

D.3 Protection

According to provincial, national and European regulations, ABG is already subject to important protection measures (Please see chapter A.6 and the application Dossier).

Where it concerns the territory within the protected area, the protection regulations are indicated in the Park's Plan. Recently, a new version of the Plan (the Variant) has been approved by the Provincial Council, with resolution n. 2306 of the 11th of September 2008. The Variant 2007 introduced significant changes also to the Earth Sciences section. The modified articles are reported below.

ART. 5 - GENERAL PROHIBITIONS
5.1 Apart from general and specific prohibitions stated by provincial regulations, the Park's Plan prohibits the following activities:
(omission)
5.1.32. – collection and removal of minerals and fossils, except when permission has been given by the Park for scientific research.

ART. 21 - PROTECTION OF GLACIERS
21.1 Table 37 identifies the extent and location of all glaciers present in the natural park. According to a communication of the Glaciological Committee, the glaciers' boundaries as determined by the Park's Plan may be reviewed as result of changes in the Park's Plan (Paragraph 3, Art.2 of present regulations), also taking into account glacial areas surveyed in the past.
21.2. From the point of view of environmental protection and management of resources, these areas are classified as zone A of an unspoiled reserve. In addition to the existing regulations for unspoiled reserves, the following prohibitions also apply:

21.2.1. –displacement of ice or snow on the glaciers, unless for scientific research reasons;
21.2.2. – movement of mechanic vehicles, unless permitted by the Executive Council.

ART. 22 - PROTECTION OF GEOSITES
22.1. The Park, in partnership with the Tridentine Museum of Natural Sciences and the Geological Survey of the Autonomous Province of Trento and within the Adamello Brenta Geopark project art.4, encourages the promotion and protection of the geological and geomorphological heritage of the Park and the areas within the territory controlled by the administration Councils.
22.2. Within the Geopark project, the Park promotes the geosites' census. The geosites are listed in table 37, according to criteria which take into account integrity, rarity, representativeness, educational exemplarity, conservation and natural state, scientific interest and scenic, historical, cultural and ecological values. The area covered by the geosites will be clearly marked, with particular prominence given to environment regulations.
22.3. The official geosites list is subject to periodic updates by means of the Annual Management Programme.
22.4. It is forbidden to transform the land in geomorphological sites
22.5. The Park will take care of the geotouristic promotion of the geosites through the promotion plan reported in art.4 of the present regulations.

E Actions for the 2008-2012 period

This section has been substituted by a summary table (chapter F). The section originally included the description of specific actions to implement and develop in the period 2008-2012 (June 2008-June 2012). At the end of the period, the Geopark work will be verified by EGN and GGN officers.

The actions were divided into three areas: Analysis, Research and Preservation. They include general initiatives which interest the whole Geopark and specific projects which concern either single geosites or particular aspects which deserve to be developed.

Apart from following the EGN guidelines, the choice of actions is based on technical-scientific assessments (derived from the assessments discussed in chapter C), combined with political-management ones. The choices will be based on specific priorities:

- high priority: necessary measure that must be carried out;
- medium priority: important measure which will be carried out once funding is available;
- low priority: interesting measure which will be carried out only within European funded projects.

Precedence has been given to the establishment of substantial structures in the Geopark, together with the promotion and protection of those geosites of primary importance. For this reason, the EGN official letter of recognition as a European Geopark of the 8th of April 2008 (Park prot.n° 2678/VII/23 30 May 08) has been taken into account. The areas for improvement are:

1. In order to gather information useful to increase public understanding of the structures and geological characteristics of the ABG area, a Geopark museum or ***interpretative centre*** *is necessary;*

2. Apart from existing and analysed geosites, it will be necessary to introduce ***new sites****, to cover the complex and interesting geological history of this spectacular geological area;*

3. Information and promotion material in ***foreign languages*** *is necessary;*

4. The number of geological projects within existing ***environmental education*** *programmes must increase;*

5. Geotouristic activities, guided geological tours and geological guidebooks are strongly recommended;

6. The creation of ***geotouristic products*** *and gadgets is also recommended;*

7. ***Promotion*** *of the geological heritage requires improvement and has the potential to become a crucial tool for further development of the Geopark.*

In order to carry out these planned actions, it is fundamental to implement the organisation measures described in chapter B. Consequently, a permanent geologist should be assigned to the Geopark. The geologist will coordinate the implementation of the Action Plan and act as a representative contact between the ABG and the EGN. Afterwards, further measures will be carried out in partnership with the Tridentine Museum of Natural Sciences and by nomination of a Geopark technical/scientific committee.

In order to monitor the Plan's implementation actions, the ABG representative will also provide an annual budget (carried out every January). Monitoring will provide an opportunity to study, analyse, verify and possibly update the results of the Action Plan. To judge the results, different "faces" of the mascot Tonalì will be used (please see the expressions of Oswald the Bear for monitoring of the CETS (European Charter for Sustainable Tourism) during presentation within the CETS forum.

F Summary table of actions (2008-2012)

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.1. Supportive actions	1.1. Staff training		2009-2010-2011	high		internal resources
	1.2. Integration of basic information tools		2009	high	SG	internal resources
	1.3. Inspections and questionnaires		2009	high		internal resources
	1.4. Computerised catalogues of geological scientific studies		2010	medium		€ 3.000
	1.5. Cartographic archive (paper support and computerised)		2009-2010	medium	SG, MTSN	€ 25.000
	1.6. Geological sites iconographic archive		2010-2011	high	SG, MTSN	€ 2.000
	1.7. Museum exhibits		2009	high	MTSN	€ 0
E.1.2. Structures	2.8. Visitor Centre "Geopark"		2009-2010-2011	high		planning: funds already committed; realisation: € 500.000
	2.9. Presentation panel	2.9.a. Update the presentation panels in the Park's structures	2009-2010-2011	high		internal resources
		2.9.b. Update of valley presentation panels	2009-2010-2011	high		internal resources

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.2. Structures	2.10. Geopark corner	2.10.a. Adamello Brenta Geopark, EGN e GGN panel in all of the Park's structure	2009-2010-2011	high		€ 4.000
		2.10.b. Totem pole in the Park's structures	2009	high		internal resources
		2.10.c. Display the official AGB recognition certificate in all structures.	2009	high		€ 1.000
	2.11. InfoPark Mavignola: geomosaic		2009	high		€ 5.000
	2.12. Natural trails	2.12.a. Head of Val Genova natural trail	2009-2010	medium		€ 30.000
		2.12.b. Vigilio Marchetti natural trail	2010	high		€ 1.000
		2.12.c. Peller-Pian della Nana natural trail	2009-2010	high	MTSN	Planning: € 5.000; Realisation: € 5.000
		2.12.d. Val di Fumo natural trail	2010-2011	high	MTSN	Planning: € 5.000; Realisation: € 5.000
		2.12.e. Doss del Sabbion-Val Algone natural trail	2010-2011	low		Planning: € 2.500; realisation: € 10.000
		2.12.f. Geoalpine route	2009-2010-2011	low	UNI PD	Provincial or regional

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.2. Structures	2.12. Natural trails	2.12.g. Val Nambrone natural trail	2010	medium		Planning: € 4.000; realisation: € 5.000
		2.12.h. Val d'Ambiez natural trail	2010-2011	high		Planning: € 3.000; realisation: € 2.000
		2.12.i. Val Breguzzo natural trail	2011 - 2012	low		Planning: € 4.000; realisation: € 5.000
		2.12.l. Cornisello natural trail	2012	medium		Planning: € 4.000; realisation: € 5.000
	2.13. "Refuges and surrounding areas"	2.13.a. XII Apostoli Refuge	2010	high		€ 1.500
		2.12.b. Segantini Refuge	2011	medium		€ 2.000
	2.14. "Quarries and surrounding areas" – Promotion of mining historical-cultural aspects	2.14.a. Tonalite Quarry in Val Genova	2011	medium		internal resources
		2.14.b. Preparation of ex Elvio little house	2011	low		€ 40.000
		2.14.c. Preparation of mine tunnel Giustino: feasibility study	2012	medium		to be defined
	2.15. Illustrative panels of single geological-geomorphological sites		2010	medium		€ 15.000

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.3. Communication	3.16. Brochures	3.16.a. ABG, EGN e GGN brochures	2009	high		Planning: internal resources; realisation: € 4.000
		3.16.b. Presentation brochure's update	2010	high		internal resources
	3.17. Website		2009-2010-2011	high		internal resources
	3.18. Geopark area filmography	3.18.a. ABG geological documentary using RTE	2010	high		€ 5.000
		3.18.b. Testing project: documentary on Brenta Dolomites geology	2009	medium	SG	€ 50.000
	3.19. Geosites and geotouristic cartography		2011	medium	SG, MTSN	see 5.34 and 5.35
	3.20. Publications in the Percorsi series	3.20.a. Head of Val Genova and Vigilio Marchetti route	2009	high		€ 8.000
		3.20.b. Val Nana route	2009-2010	medium		€ 10.000
		3.20.c. Val di Fumo route	2010	high		€ 10.000
		3.20.d. Vallesinella route	2011	high		planning: € 4.000 ; printing: € 8.000

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.3. Communication	3.20. Publications in the Percorsi series	3.20.e. Val d'Ambiez route	2011	medium		€ 2.500
		3.20.f. Val Breguzzo and Arnò route	2012	low		€ 10.000
	3.21. Publications in the Guidebooks series	3.21.a. Guidebook Geology of Adamello-Presanella and Brenta Dolomites	2011	high		€ 10.000
		3.21.b. Glacialism and Permafrost guidebook	2012	high		€ 10.000
		3.21.c Karst guidebook	2013	high		€ 10.000
	3.22. Audio guides	3.22.a. Audio guide Val Genova waterfalls path	2009	medium		€ 20.000
		3.22.b RTE video guide as aid to the audio guide	2010	low		€ 5.000
	3.23. DBB and DBT paper Guides		2010	low	APT	Regional
	3.24. Mascot		2009	high		€ 5.000
	3.25. Merchandising	3.25.a. T-shirt	2008	high		already completed

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.3. Communication	3.25. Merchandising	3.25.b. "Anti-stress" tonalite stone	2009-2010	high		€ 3.000
		3.25.c. Tonalite stone produced by social cooperatives	2010	high		€ 5.000
		3.25.d. Calendar book on geosites painted by Giovanna d'Avenia	2011	high		€ 6.000
		3.25.e. Principal Geosites posters and postcards	2011	medium		€ 2.000
		3.25.f. Geosites bookmarks	2012	medium		€ 2.000
	3.26. Logos and graphics	3.26.a. Designing new logos	2008-2009	high		internal resources
		3.26.b. Designing headed paper graphic	2009	high		internal resources
E.1.4. Activities	4.27. Schools	4.27.a. "Glass factories: tradition and culture" project expansion	2008-2009	high		internal resources
		4.27.b. "Park in all senses" project expansion	2009-2010	high		internal resources
		4.27.c. "Botanic diversity of the Park" project expansion	2010-2011	high		internal resources

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.4. Activities	4.27. Schools	4.27.d. Inclusion of Earth Sciences related steps into the project "A day in the Park"	2008-2009-2010-2011	high		internal resources
		4.27.e. Experimental project "Geology" at the Guetti Institute	2009	high		internal resources
		4.27.f. Didactic forms of the project "The Geology of the Park"	2009	high		internal resources
		4.27.g. Didactic forms of the project "Minerals and rocks of the Park"	2011	high		internal resources
	4.28. External training	4.28.a. Training courses for Trentino's teachers	2009-2010-2011	medium		internal resources
		4.28.b. Training courses in partnership with national organisations	2009-2010-2011	medium		internal resources
		4.28.c. Training for public administration organisations and services	2009-2010-2011	medium		internal resources
	4.29. University high level training	4.29.a. Preparation of contact network with universities	2009-2010-2011	high		internal resources
		4.29.b. Post-graduate Master (summer school)	2010-2011	medium		internal resources
		4.29.c. Survey on interest among universities for research and teaching in ABG	2010-2011	medium		internal resources

E.1. INTERPRETATION						
Area	**Action**		**Schedule**	**Priority**	**Partner**	**Financial commitment**
E.1.4. Activities	4.30. Geotourism		2009-2010-2011-2012	medium	MTSN	€ 30.000 per year
	4.31. Awareness and involvement of residents	4.31.a. Presentation of Action Plan to city Mayors	2008	high		internal resources
		4.31.b. Special edition of the ABG magazine	2009	high	MTSN, SG	€ 13.000
		4.31.c. Planning of meetings and public debates within the CETS Forum	2008-2009-2010-2011	high		internal resources
		4.31.d. Planning of evening events on Earth Sciences themes	2008-2009-2010-2011	medium		internal resources
		4.31.e. Training for local businesses	2008-2009-2010-2011	high		internal resources
		4.31.f. "Park Quality" training course for hotel operators	2008	high		internal resources
	4.32. Geoparks week		2009-2010-2011	high		Commitments within the Park fair
	4.33. Meeting, Workshop and conferences	4.33.a. Attendance of the official ABG representatives to the two annual meetings	2008-2009-2010-2011	high		€ 2.000
		4.33.b. Organisation of the 2° Workshop for Italian Geoparks	2009 - 2010	high		€ 5.000
		4.33.c. Organisation of the EGN Meeting	to be defined	high		€ 10.000
		4.33.d. Attendance of conferences, fairs, courses on Geopark topics	to be defined	high		€ 3.000

E.2. SCIENTIFIC RESEARCH				
Action	**Schedule**	**Priority**	**Partner / Leader***	**Financial commitment**
5.34. Thematic cartography (detailed geological and geomorphological)	2010	high	SG*	Partnership with internal resources
5.35. Project on geological risk assessment along hiking trails, near rest areas and geosites	2011	medium	SG*	Partnership with internal resources
5.36. Research and project development on karst areas' hydrogeology	in progress	low	SG*	Partnership with internal resources
5.37. Permafrost monitoring research – PERMANET project	in progress	high	SG*	Partnership with internal resources
5.38. Stratigraphic, paleontological and mineralogical research	2011 - 2012	medium	MTSN	€ 8.000 (€ 4.000 annual)
5.39. Research on ice volume loss from the LIA to present time	2012	low	Glaciological Committee SAT, SG	€ 20.000
5.40. Study of fossil earthquakes in the Adamello-Presanella Massif	in progress	medium	MTSN*	€ 0
5.41. Geodiversity/biodiversity	to be defined			

E.3. PROTECTION				
Action	**Schedule**	**Priority**	**Partner**	**Financial commitment**
6.42. Protection measures according to attachment 3	always	high	SG	internal resources
6.43. Protection procedure of the Geosites Grotta Silvia and Fossil deposit Val d'Ambiez	2011	high	MTSN	€ 5.000
6.44. Geosites outside the Park designated as invariants	2012	high	SG	internal resources
6.45. Precise location and borders of geosites with Park's database update	2009 -2010-2011	high		internal resources
6.46. Identification of new Geosites	2009-2010-2011-2012	high	SG, MTSN	internal resources