

Geotourism in Ida Outananes Moroccan Western High Atlas: State of Valuation and Opportunity of Improvement

Noureddine BOURCHICH¹, Hanane ADARAB¹ & Abdelkrim EZAIDI¹

¹ Faculty of Sciences, Ibn Zohr University, Agadir, Maroc

Correspondance: Noureddine BOURCHICH, Laboratory of Geoheritage and Geoenvironment, Faculty of Sciences, Ibn Zohr University, Agadir, Maroc. Tél: 2126-6182-1253. Noureddine.bourchich@edu.uiz.ac.ma

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Abstract

In the light of the negative repercussions of the physical environment exploitation in economic purposes, the geologic substratum was set up as a heritage to preserve and manage sustainably. This new approach to debate the component of the natural environment holds its foundations of the experiences registered during the 1990s which made succeed in the decision taken by the

United Nations Educational, Scientific and Cultural Organization (UNESCO) to promote a world network of geosites presenting particular geological characteristics, by adopting the Geotourism as one of the important elements for regional development.

Morocco has followed this international trend through the integration of a nature tourism development program as part of national tourism development strategy. The territory of Ida Outanane constitutes one of the target experimental spaces of the Moroccan Western High Atlas; the main reason of its choice is its fascinating natural and cultural resources. In this territory, the valuation of this ecological support shows a state of deterioration what threatens as well the quality of Geosystems, Ecosystems and the tourist attractiveness.

This deterioration is a result of the opening of this space for tourist activity without a mechanism of management integrating a geopreservation program with a sustainable financing. Today, the payment of the environmental services (PES) may be an effective mechanism for a sustainable valuation of the geoheritage.

Keywords: Geodiversity, Geosites, Geopreservation, Payment of the Environmental Services, Ida Outanane, Moroccan Western High Atlas

1. Introduction

1.1 From Geodiversity to Géotourisme

The natural environment with its two components, geodiversity and biodiversity, constitutes the material support of the human life. However, in the plans of the conservation and the valuation, the component biodiversity was always the first target of thorough scientific studies, and the scope of the new tools identified within the framework of process on sustainability and environmental dimension.

Today, in the same way as the biodiversity, this natural component deserves a scientific study and a detailed valuation. It is important to underline that any degradation and change in the Geodiversity level, either pulling directly or indirectly, a declension and an extinction of the biodiversity can occur. In front of this situation, the International Declaration of Human Memory and the Earth spoke about a “geologic heritage”. This notion was more improved by researchers such as Grandgirard (1997), by adding the shutter geomorphology and so to speak about a “geologic and geomorphologic” heritage. This really makes and explicitly references to the Earth sciences in its complete entity.

In the light of this awareness, the physical environment becomes a component with big interest studied according to a multidimensional approach by being interested in the various aspects connected to the geology and to the geomorphology. This new approach, which we can consider as soft, contributes to the minimization of the environmental impacts, although it does not guarantee the absence of negative visual effects on the landscape. This way takes into account first scientific interest, which does not exclude the aesthetic, cultural and economic components, the importance of which can be stronger or lower (Panizza, 2003; Reynard, 2005).

The concept of geotourism is defined in a varied way, mainly according to two axes which correspond to the aspects of protection and valuation of a site or a region. For the National Geographic Society, the geotourism is a shape of tourism which supports or improves the geographical character of a locality, its environment, heritage, aesthetics, culture and the well-being of its residents. Among the definitions emanating from scientific circles, putting forward clearly the aspect of valuation, we hold that of Dowling and Newsome (2010) who takes back the definition of geotourism, while developing this concept in a more complete sense by summarizing well the main stakes in the geotourism: 'Geotourism is a form of natural area tourism that specifically focuses on geology and landscape. It promotes tourism to geosites and the conservation of geodiversity and an understanding of earth sciences through appreciation and learning. This is achieved through independent visits to geological features, use of geo-trails and viewpoints, guided tours, geo-activities and patronage of geosite visitor centres'.

Geosites represent the geological or geomorphological sites having an interest for the Earth sciences and which are the portions of the nature took for target within the framework of the geotourism. Reynards (2005) definition of geosites, considers this word as synonym for "geotopes", "Earth science sites" and "geoscience sites".

The inventorization of geoheritage sites in Morocco is still in its early stages, despite a few localized attempts by the Universities (El Hadi and al., 2011). Only the Scientific Institute, founded in 1920, was tasked to perform in the field of natural science basic research, especially regarding the systematic inventory of the physical and biological environment. It helped provide a national preliminary inventory mainly in zoology and botany.

The Hassan II Academy of Science and Technology supports a large-scale national project on the geoheritage of Morocco, with contributions from all sectors of Moroccan civil society. In the same context, the International workshop on inventory strategies of the Moroccan geological heritage, organized in 2014 by the Moroccan Association of Earth Science, proposed to establish an inventory system for sites and geological objects and creation of a national litho-library.

1.2 Geotourist Strategy of Morocco

At the international level, Morocco followed the international tendency of conservation of the natural environment particularly through its membership to the conventions and the agreements held to this end. Today, we count one national Geopark, who has an international fame: "Global Geopark of M'Goun". This status of the UNESCO granted to a part of the Moroccan High Atlas, during the 6th world Conference of Geoparks in Canada on September 22nd, 2014, will constitute a platform to support the process of conservation and valuation of the Moroccan geodiversity.

On a national scale, tourism ministry adopted since 2001 (vision 2001-2010), a development program of the rural and natural tourism in the national tourist strategy of development. The approach of this program implementation was the concept of Tourist Host Country (THC), tool inspired by the French experience regarding development of the rural tourism. So, within the framework of the new tourist vision adopted by the Moroccan government (2010-2020), the natural tourism benefited from a specific program endowed with ambitious budgets to know the Qariati program.

This dynamics, allowed several Moroccan territories to benefit from conservation and valuation actions of the natural heritage, what has favorably supported the existing tourist dynamics.

2. Material Studied

2.1 Study Area

The Ida Outananes area is situated in Western High Atlas mountain of Morocco. It is limited to the North by the province of Essaouira, to the East by the province of Taroudant, to the South by the city of Agadir and to the West by the Atlantic Ocean. This mountain space is part of the administrative territorial division of Agadir prefecture. Its surface is 1952 km² representing 85 % of Agadir Ida Outanane surface.

This territory was chosen as one of the target experimental spaces within the framework of the national strategy of rural and natural tourism (references). The criteria of this choice are its strategic location, its proximity of Agadir as the first seaside tourist attraction in Morocco, and its fascinating geological and geomorphological resources.



Figure 1. Map location of our study area (Bourchich, 2015)

2.2 Methodology

This work was based on a bibliographical research, field visits, and surveys. The bibliographical studies touched aspects and concepts related to the natural heritage specifically two shutters: geology and biology, and tools developed within the framework of the sustainable development.

Field investigations visits focused on identification of geosites that can be valued as part of a geotourism development project. It also allowed us to estimate the valuation state of geological and geomorphological heritage through an analysis of the actions realized as part of the tourism ministry strategy (THC). Criteria of selecting geosites

Concerning the survey part, it was question to proceed by interview guides and questionnaires, to question institutions charged with the putting open of the tourist ministerial strategy on the realized actions of valuation, the visitors on their appreciation and their recommendations with regard to the existing geotourism product and the providers of tourist services about the dynamics recorded at the level of their establishment.

3. Geological Setting of Ida Outanane:

The sedimentary series of Ida Outanane are essentially constituted by formation of the Jurassic which appears in the hearts of the Anklout, Imouzzer and Lgouz Anticlinals (Figure 2).

- ✓ The Ameskroud RED BED Formation (Duffaud and al., 1966): average Aalenian-Bajocian thickness is of 250m, essentially formed by silts, conglomerates and red stoneware's. The deposits are fluvial with marine influence towards the summit (Bouaouda , 2004);
- ✓ The Ouanamane Formation (Adams and al., 1980): the age of this formation is between upper Bathonian and basal lower Kimmeridgian. The thickness is about 100 m. with metamorphic facies dominating in this sedimentary: limestone with oolites, limestone clay containing brachiopods, green clays and green marls. This formation is the equivalent of three sedimentary formations defined by Duffaud and al., 1966: dolomites of Amsittène, limestone of Anklout, and marl of Anklout. The depositional environment is a carbonated distal banister, a transition to the external basin type (Bouaouda, 2004);
- ✓ The Tidili Formation (Bouaouda, 2004) or formation of Lalla Oujja (Adams and al., 1980), of age Callovian- lower Kimmeridgian, is dominated by a reef facies, marked by an oolitic bar or sandy of high energy. These limestone bio-built polyparies, Diceras and Nerinea appear in the localities of CapGuir, Lalla Oujja, Taghrat Ifesfassene and at the foot of Jbel Taznakht;
- ✓ The Iggui El Behars Formation age is upper Oxfordian-lower Kimmeridgian (Adams and al., 1980). The dominant lithologic facies is fine limestone, beige dolomites, yellow marls and laminitis. The environment of formation is an internal carbonate platform corresponding to lagoon domain;

- ✓ Kimmeridgian corresponds to Imouzzer red marls Formation of about 140m of thickness with numerous evaporitic horizons in the summit. This formation is distinguished by the presence of red clays “chocolate-brown marls” of Ambroggi (1966);
- ✓ Portlandian is represented by the TISMEROURA Formation according to Adams and al. (1980) equivalent of dolomitic limestones formation of Ihchach according to Duffaud and al. (1966). It varies from 140 to 240m of thickness and includes dolomitic limestone in gypsum and grey or green marls in alternation. In the landscape this formation trains cliffs of the right bank of Assif Ouankrim.

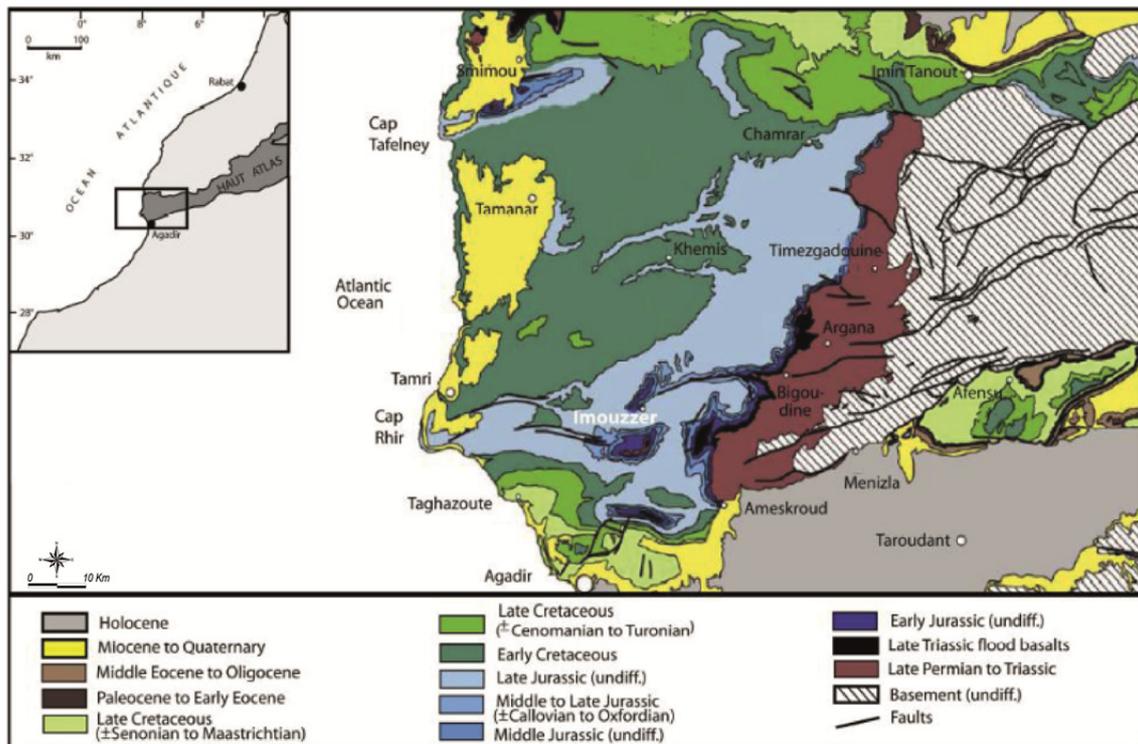


Figure 2. geologic map of Ida Outanes Western High Atlas. Choubert et al. (1956), and Saadi (1982)

4. Western High Atlas: Geosites with a Great Geoscientific Potential

The diagnosis realized on this mountain territory allowed us to identify a geologic map integrating six sites as heritage geosites of the Ida Outanes region (Figure 3). These sites are perceived as having not only a scientific value, but also a scenic, cultural and economic interest.



Figure 3. location map of the identified geosites (Bourchich, 2015)

4.1 Kimmeridgian Reef of Cap Ghir

In Cap Ghirs site, the complex reef of this important period of the earth history is a limestone bio-built in polyparies (Figure 4) and in Stromatoporoidea belonging to Upper Jurassic carbonate formations.

The reefal and pre-reefal procession is particularly rich in Nerinaea (gastropods) and Diceras (lamellibranch). Levels of marl limestone or bioclastic show a big wealth of benthic foraminifera species such as Alveosepta jaccardi, allowing an attribution of this series to lower kimmerdgian (Ourribane and al.,2000).

The sedimentological study seems very complex and interesting for several reasons; it particularly allows to observe, in both time and space, four installation stages of the reef phenomenon: stabilization, colonization, diversification and domination.



Figure 4. Reefal biodiversity of Cap Ghir (Ezaidi, 2015)

The objectives targeted by their study are:

- i. Reconstitute the environmental deposit and evolution of the reefal system,
- ii. Reconstitute the history of the development of these bio-constructions by referring to the current reef bio-construction of the Australian barrier Queens Land
- iii. Analysis of marine paleo-environment during Jurassic at the Western High Atlas.

4.2 Cave of Win Timdouine (Plateau of Tassroukht)

The plateau of Tasroukht is formed by upper Jurassic limestone, strongly lapiazed and strewed with hills and sinkholes. This karstic network is mainly drained by the underground river of Win Timdouine. Recognized by the speleologists on 6 km, the cave of Win Timdouine which constitutes one of the big sites with speleological vocation on Moroccan scale is considered as a perfect illustration of the phenomenon of the karstification in the South of Morocco.

Win Timdwine's source establishes that this is the only release of the underground river of the hydrological pond Tasroukht. The river explored in total 8.5 km in length to be the longest underground river of North Africa. Its flows are variable and conditioned according to the seasons, and its water, is slightly lesser than those in other sources of the region (Qurtobi, 1996).

The objectives targeted by its study are:

- i. Initiation into the practice of speleology,
- ii. Observation and interpretation of different karst forms (caves, stalactites, stalagmites, sinkholes),
- iii. Analysis of the dissolution phenomena and Jurassic limestone deposits of the Ida Outanane.

4.3 Valley of Ouankrim

The Ouankrim valley counts among the most spectacular in the back country of Agadir tourist area. Geologically, this geosite materializes the passage from Jurassic to Cretaceous. It shows a distinct lands cape diversity with immense cliffs reaching more than 200 m of height, deep canyons and magnificent natural lakes dug in limestone layers of the Jurassic (potholes).

This valley generally known under the name of "Paradise Valley" "was related to a place of pilgrimage of the followers of the hippy movement towards the 1970s. The name of "Paradise Valley" was moreover given by these amateurs who came to stroll and to look for refuge in the nature and to benefit from what can offer them this space formerly wild and utopian. It is crossed by Ouankrim river wich assures a permanent hydrological supply throughout the year.



Figure 5. Potholes formed along Ouankrim river: figures dissolution of carbonate that grow by the flow of fluvial waters. In periods of high heat, these natural pools are a delight for swimmers. (Ezaidi, 2014)

4.4 Valley of Tanit

The Tanit Valley is an exceptional geosite which includes a geodiversity related to geological phenomena (sedimentation, tectonics, fossilized, erosion ...) that project into the space of the valley and in time the main geologic interest for this geosite is the illustration and the interpretation of a reefal paleo-environment of the Jurassic.

At the level of this site, other geological phenomena are identified:

- The geomorphology: karstic forms, fluvial forms



Figure 6. The karstic forms, fluvial forms (Adarab, 2013)

- The Paleontology: fossil sites



Figure 7. Fossil sites (cretaceous ammonites) (Ezaidi, 2014)

Despite its large geographical extent, the valley is moderately frequented except by the mountain dwellers and some hikers. It is also crossed by a permanent stream fed by several sources such as the source of Ouggoug, Ilbdi, Oumoujig, Iouzid....

4.5 Waterfalls of Lakhmiss Ida Outanane

Waterfalls of Lakhmiss Ida Outanane are one of the most appreciated natural sites in Ida Outanane country with high scenic value, particularly during the spring months and after a rainy winter.

Locally called "Tougoukt", these waterfalls are situated at the bottom of the valley and at the foot of two small villages, Tidili and Tamarout. They are also known under the name of "five waterfalls" with refers to the number

of sources where the water is coming from.

They illustrate the travertines of Imouzzer, built on the successive waterfalls of Assif N'Ait Oualla tributary (high branch of Tamri river). These waterfalls result from the crossing, in the transverse valley, of an anticlinal zone dominated by limestone and dolomitic formations of the Upper Jurassic (Ambroggi, 1963).



Figure 8. waterfalls of Lakhmiss Ida Outanane (Bourchich, 2014)

4.6 Bioconstruction of Tiqqi

4.6.1 Lalla Oujja Formation

This formation shows a structure of polyps and algae reefs, which frequently developed in a coral sea. The presence of the benthic foraminifera: *Alveosepta jaccardi* confirms a lower Oxfordian- kimmerdgian age for Lalla Ouajja formation. Complex hexacorals Bioconstructions, large-sized seaweeds (in position of life), and "Patch reefs" are observed. However, the most massive parts of this formation are almost completely dolomised, and show a profound karstic deterioration.



Figure 9. Reef-building of Lalla Oujja (Ezaidi, 2013)

4.6.2 Ouanamane Formation

The biofacies of this geosite shows that brachiopods constitute its most common faunal element, essentially *Terebratulidae*, *Zeilleria* and *Rhynchonellidae* Somalirhynchia. The other macrofossils found include *Ostreidae* and sporadic echinoderms.



Figure 10. Brachiopods (Rhynchonellidae Somalirhynchia) (Ezaidi, 2013)

4.6.3 Ameskrout Red Bed Formation

It is mainly composed of red clastic rocks, with a general trend of grain size decreases in gup wards. The series thickness 250-300m is very constant through the entire region; however the Ameskrout red bed has generally a size grading finer than those situated at the next size down, and the grains which constitute them are better distributed and better rounded off at the same time. Cements are calcareous and rich in iron.

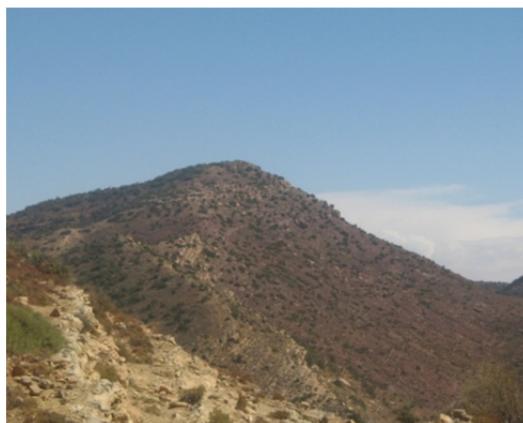


Figure 11. Ameskrout red bed Formation (Ezaidi, 2013)

5. Valuation State of Geosites

Except for the limited valuation action of the cave Win Timdouine illustrated in a driveway to the site and an external arrangement brought to the cave entrance, the others valuation actions of the geosites did not practically concern the geological heritage. All the touristic development projects are directed to the valuation of biodiversity as part of the Biosphere Reserve of Argan tree (RBA) granted by the UNESCO to the region of Agadir.

However, there is a spontaneous local dynamics, particularly at the most valuable geosites of the territory.

Local inhabitants collect fossils and expose them to visitors in small kiosks at the road side; many prototypes are made and sold to the tourists. This dynamic is illustrated at the level of Tanit geosites, Lakhmiss Ida Outanane waterfalls and Win Timdouine cave. Although, their vocations as fossils and casts outlets, these kiosks are an interface of raising awareness and education to the preservation of the fossiliferous wealth of the area.

At the Win Timdouine geosite, the promoter of a hosting structure in the country exposes in his holiday cottage the scientific process and stages of the cave formation. This structure is specially designed to accommodate the amateur visitors and experts of speleology. Another thematic accommodation at Tiaqi geosite is developed around the bioconstruction formations, referring to the establishment named "Zolado"; a local name carried by a large-sized rock very exposed and shaped by winds.

So, this experience of Ida Outananes Moroccan Western High Atlas contributes to the valuation of the geological heritage through:

- Initiation into the geotourism via the valuation of Win Timdouine cave;
- Implementation of the accommodation connected to the rocks and their aspects;
- Discovery of geosites with great touristic potential (potholes, canyons of Ouankrim...).

6. Environmental Threats That Arise at Ida Outanane Geosites

The analysis of the tourist demand of Ida Outanane (Figure 12) revealed an unbalanced distribution of touristic flow. The latter is estimated at 8000 overnight stays and at more than 6000 arrivals annually, concentrate at the level of three geosites which are Ouankrim valley (rural district of Aqessri), Lakhmiss Ida Outanane waterfalls and Tiaqi.

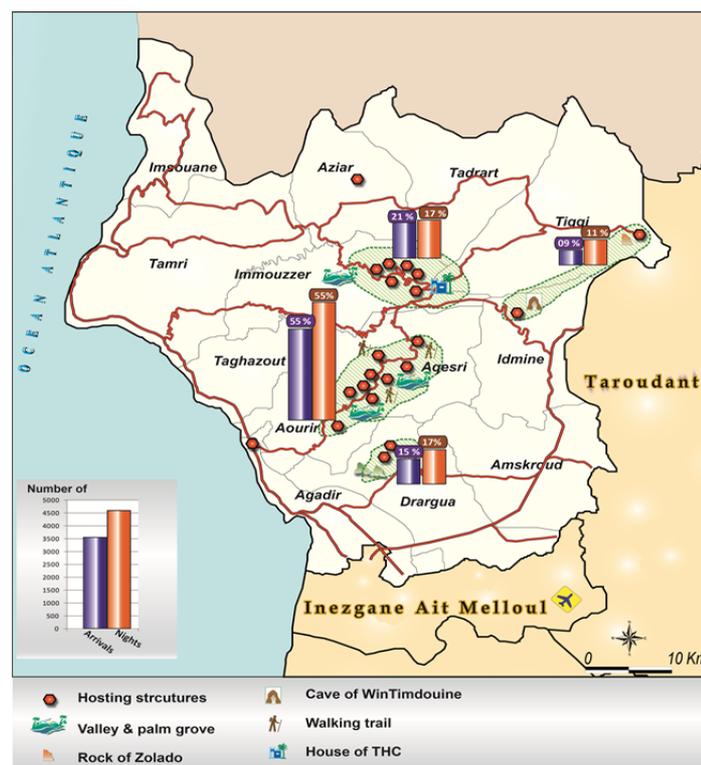


Figure 12. distribution of the flow, (Bourchich, 2014)

The field prospection has allowed to identify the main environmental threats causing the geosites degradation at Ida Outanane region such as:

- Problems of waste generally abandoned by visitors, which represent the real threat to the quality of the environment (ground, water, air);
- Informal marketing of ammonites and deterioration of other fossils such as assea urchins and brachiopods. The situation of the paleanthological heritage is more and more alarming as there is no organized protection or legal status to clamp down on illegal trade and to ensure geoheritage sustainability;
- Urbanization of precious sites which is at the source of the socioeconomic dynamics outlined there;
- Anarchic tourist exploitation at the level of some geosites with great potential (Cave Win Timdouine, Paradise valley, waterfalls sites);
- Lack of signage, informative and interpretive systems;

- Absence of local guides mastering the geoscientist frame of Ida Outananes territory and its geosites.

Today, all these degradation factors affect already negatively the tourist attractiveness for Ida Outanane. In fact, according to our field survey relative to the assessment of customer satisfaction, only 13 % were satisfied with the environment quality (Figure 13).

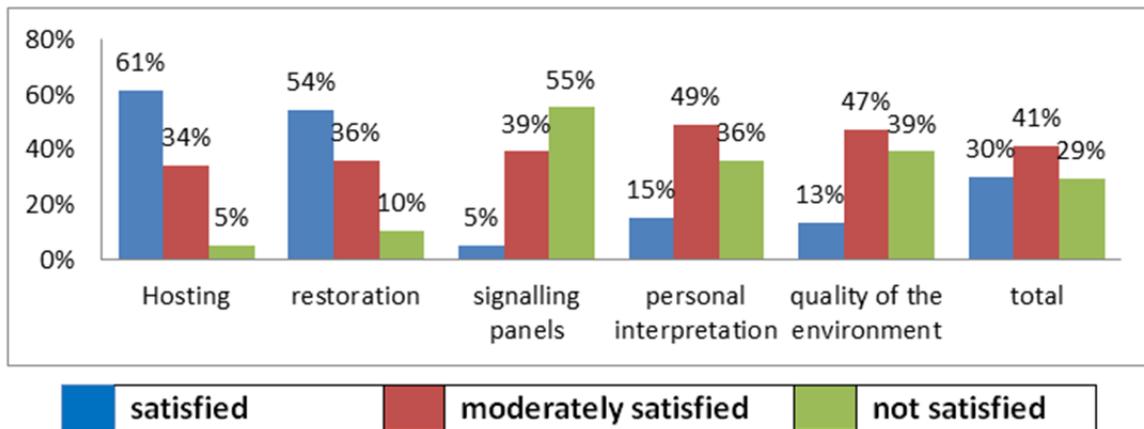


Figure 13. Assessment of the customer satisfaction (Bourchich, 2014)

7. Payment for Environmental Services (PES): tool to protect the regional geodiversity

7.1 Definition of System PES

All PES schemes share an objective: providing environmental services that are undersupplied due to the lack of compensatory mechanisms. They provide a mechanism through which services can be provided in a cost efficient manner. PES schemes seek to formulate a certain value to environmental services and establish appropriate pricing, institutional and redistribution systems that will lead to sustainable and socially optimal land use practices. These schemes tend to work best when the value of environmental services is high for beneficiaries and the cost of providing the services is low (Mayrand & Paquin, 2004).

This concept also sends back to the profits which companies remove from their interactions with the world living "biodiversity" and inanimate "geodiversity" (Houdet and al., 2012). Profits connected to the geodiversity recover globally besides landscape, the fundamental impact regarding knowledge and educational connected to our inheritance which allows explaining the current state of the site or the territory (Earth sciences).

According to Wunder, 2005, we use relatively five simple to describe the PES principle. A PES is:

- 1) a voluntary transaction
- 2) a well defined Environmental Service (ES) (or a land-use likely to secure that service)
- 3) is being "bought" by a (minimum one person) ES buyer
- 4) from a (minimum one) ES provider
- 5) if and only if the ES provider secures ES provision (conditionality).

7.2 The Rationale for the Selection of a System PES Applied to the Geodiversity

Geodiversity means the variety of environments and geological aspects that we observe, it is clearly vulnerable to multiple aggressions to which the environment is exposed. It became, consequently, more than ever necessary to conceive and to set up a tool assuring the protection and the preservation of this system.

This geodiversity deserves a detailed scientific study in the same way as the biodiversity. It is important to underline, in this regard, that any degradation and change of geodiversity leads, directly or indirectly to declension and extinction of biodiversity in the extreme case, "Numerous geotopes are -contrary to various biotic habitats - practically irreplaceable, because of their genesis" (Heidi Megerle & Anja Beuter, 2010).

For the analysis of the "geodiversity", the geosystem model substitutes itself for the ecosystematic model, and is based on the following points:

- Organization of environment and landscapes;
- Study of environmental and landscape changes ;

- Study and an analysis of landforms and relief, landscape and geosystem.

This allows concluding that, just as biodiversity, geodiversity is an environmental component which presents benefits for local communities. It also offers environmental services that are of cultural and symbolic order, exploited in the local socioeconomic development. As detailed by Wunder (2005) for the ecosystem services, the objective of PES mechanism is to intervene in management mode and tourism operating practices of these geosites through the definition of a clear geoconservation program, mutually approved by the administrator of the site and the interested tourists (Figure 14).

According to the same principle developed by Wunder (2005), the financing of this so called program of geoconservation will depend on the opportunities of the voluntary payments for these environmental services offered by geosites (cultural and entertainment services). This spending will be bound to the implementation of the principle "avoid, reduce, compensate".

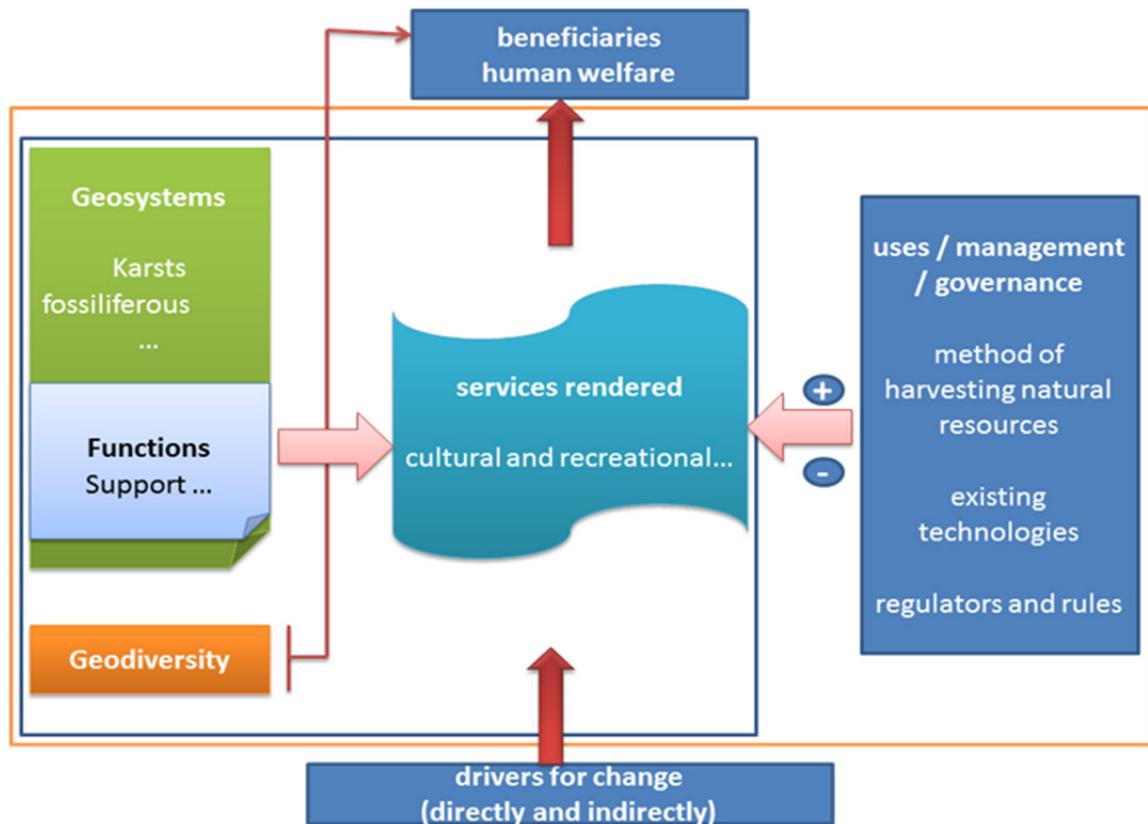


Figure 14. model of Payment for Environmental Services (geodiversity), (Bourchich, 2014)

7.3 PSE System and Geoconservation in Ida Outanane

The field study, exactly at the level of three pilot geosites of Idaoutananes to know the valley of Ouankrim, the waterfalls of Lakhmiss Ida Outanane and the Tiqqi, demonstrated the applicability of the system PES. The five criteria of success of this system were verified and defined as follows:

critierion 1	- 94 % of tourists are ready to pay a price provided that it is to reserve exclusively for an action of geoconservation. - These tourists are predisposed to pay 10% to 30 % of the total cost of the stay (3\$ US-10\$US)
critierion 2	The program of geoconservation: - Preservation of the geosite (elimination of waste, arrangement of paths); - Put in place a signalling system of interpretation and of orientation; - Possibility of having an interpreter/presenter (guide) of the geosite who masters the various aspects linked to the geological and biological forms of the site.
critierion 3	The applicants of geoconservation program present the same profile as the tourists of Agadir: 75% are young people seeking adventure (hiking, Cave diving...), that have a

	high-level of education (secondary, university) and interested in local culture.
critérium 4	Association of the tourist host country of Ida Outanane looking forward to the creation of the local development company, planned within the framework of the program of the tourism ministry.
critérium 5	Signature of an agreement which commits the administrator of the geosite to ensure the program of geoconservation

The implementation of PES system, will allow besides the Conservation of geosites, other results namely:

- Strengthen the local and regional tourist dynamics through the development of a geotourist offer;
- Create of income-generating activities (guides, craftsmen, hosts...);
- Enrich the local culture through the scientific inheritance which explains the current state of the site.

8. Conclusion

Actually, in our study area, we cannot talk about a truly organized geotourism with sites of interest network and whose offer would be intended for a particular clientele. The proof is the low promotion of these sites, which is due to a misunderstanding in the tourist areas of their scientific and economic values.

This situation is also at the origin of the strong interest carried by the decision-makers and the administrators of this natural space, for the benefit of the biodiversity and of the cultural heritage.

To establish a geotourism philosophy and to concretize these concepts on the ground, it is necessary at first to understand how geological and geomorphological sites can be valued, exploited and managed within the framework of leisure, relaxation and culture activities. Then, each of these aspects needs to be integrated, as much as possible, into a model that is able to synthesize the stakes of this issue. Our attempt, in this regard, is represented by the payment of environmental services model.

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