# Geotourism in Latin America and Caribbean UNESCO Global Geoparks: Contribution for Sustainable Development Goals


**Emmaline M. Rosado-González, José Luis Palacio-Prieto, and Artur Abreu Sá**

**Abstract** A key feature of the UNESCO Global Geoparks (UGGps) is their contribution to regional sustainable development through initiatives and strategies of geoconservation, geoeducation and geotourism, promoted in cooperation with the local communities. In this sense, UGGps are committed to promote and carrying out activities that contribute to Agenda 2030 and its 17 Sustainable Development Goals (SDG). This Agenda, established in 2015 by United Nations, is assumed as a plan for planet, people, peace, prosperity and partnerships.

The geotourism as one of the main axes of the UGGps, sensu Arouca Declaration (2011, aroucageopark.pt/documents/78/Declaration_Arouca_EN.pdf), and the geotouristic initiatives developed on UGGps could be an effective tool to contribute for the sustainable development of these territories.

This work is part of a broader research that aims to characterize the contribution of UGGps in Latin America and Caribbean (LAC) region to the Agenda 2030 and its 17 SDGs. However, in this work we focused mainly on the impacts of geotourism in the UGGps. The main objective is to show some evidences on how the geotourism strategies and activities carried on the four UGGps in LAC until early 2019 (Araripe UGGp in 2006—Brazil; Grutas del Palacio UGGp in 2013—Uruguay, Comarca Minera UGGp and Mixteca Alta UGGp in 2017—Mexico) are contributing in the scope of the SDG 8, SDG 9, SDG 10, SDG 11 and SDG 15.

The field work research was composed on the application of questionnaires and the development of workshops with the local communities of these four territories. The obtained results were based on the perception of the local communities and the

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impression they have of the impacts of the UGGps on their territories. This allowed to describe the evidences on how UGGps contribute on different ways to the Agenda 2030, particularly showing the impact of geotourism in specific targets, such as employment promotion, establishment of sustainable infrastructures, reduction of inequalities and the environmental conservation, among others. This work explains with a concrete case study the benefits that each territory can gain with a good promotion of geotourism strategies under the UGGp label.

**Keywords** UNESCO Global Geoparks · Sustainable Development · Latin America and Caribbean · SDG 8 · SDG 9 · SDG 10 · SDG 11 · SDG 15

## 1 Introduction

During the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, was adopted by 178 Governments the Agenda 21, known as the "Rio Declaration on Environment and Development, and the Statement of principles for the Sustainable Management of Forests". This Agenda was assumed as "*a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment*" (UN, 2018). This initiative still being considered one of the most relevant precursors of the world sustainable development initiatives.

In this scenario the different programs and initiatives worldwide focused on the sustainable development of the territories consider this Agenda as one of their main backgrounds. This is the case of the UNESCO Global Geoparks (UGGps). The Agenda 21 was followed-up by diverse international protocols and agreements focused on the its different topics. As example of this reality we can mention the Istanbul Programme of Action for the Least Developed Countries, the Paris Climate Change Agreement, the Addis Ababa Action Agenda, the Sendai Framework for Disaster Risk Reduction, the Education 2030 Incheon Declaration and Framework for Action, the Strategic Plan for Biodiversity 2011–2020, the Aichi Targets, and the Millennium Development Goals (UN, 2016a; UNESCO, 2015a, 2015b).

In 2000, the United Nations (UN) established the Millennium Development Goals (MDGs) which intended to be a 15 years plan, which ranged from halving extreme poverty rates to halting the spread of HIV/AIDS and providing universal primary education up to 2015 (UN, 2016a, 2016b, 2016c, 2016d). The MDGs then established considered eight main goals:

- Eradicate extreme poverty and hungry;
- Accomplish universal primary education;
- Promote equality gender and woman autonomy;
- Reduce infant mortality;
- Improve maternal health;

- Fight IHV/AIDS, malaria and other diseases;
- Guarantee environmental sustainability;
- Promote a global association for development.

However, after this time frame, the UN decided in 2015 to go forward with this plan, establishing the Agenda 2030 for Sustainable Development, which was assumed as a plan for planet, people, peace, prosperity and partnerships, composed by 17 Sustainable Development Goals and 169 targets.

In this scope, was also in 2015 that the General Assembly of UNESCO approved the creation of the International Geosciences and Geoparks Programme (IGGP), which assumed the compromise to work towards the Agenda 2030. Nowadays there are 147 UGGps around the world in 41 countries. In Latin America and Caribbean (LAC) until now we have seven UGGps: Araripe UGGp, recognized in 2006 in Brazil; Grutas del Palacio UGGp, recognized in 2013 in Uruguay; Comarca Minera UGGp and Mixteca Alta UGGp, both recognized in 2017 in Mexico; Kültralkura UGGp, recognized in 2019 in Chile; Colca y Volcanes de Andagua UGGp, recognized in 2019 in Peru; and Imbabura UGGp, recognized in 2019 in Ecuador.

The UGGps are territories where sites and landscapes of geological relevance are managed trough a holistic way of protection, education and sustainable development involving the local communities (UNESCO, 2019). The UGGps management structure is based in three main axis of action: geoconservation, geoeducation and geotourism. The last one is defined as the tourism which sustains and enhances the identity of a territory, taking into consideration its geology, environment, culture, aesthetics, heritage and the well-being of its residents (Arouca Declaration, 2011). In this sense, the geotourism can be a way to contribute to the United Nations Agenda 2030 for local sustainable development, particularly on the SDG 8 "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"; the SDG 9 "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"; the SDG 10 "reduce inequality within and among countries"; the SDG 11 "make cities and human settlements inclusive, safe, resilient and sustainable"; and the SDG 15 "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" (UN, 2015).

## 2 UNESCO Global Geoparks and Their Framework in Latin America and Caribbean

In 1996, during the 30th International Geological Congress held in Beijing, at the geological heritage session, was discussed what should be the appropriate strategies to promote geoconservation. The last concept should be interpreted as the conservation of geodiversity due to its intrinsic, ecological and geo-patrimonial values. In the other hand, geodiversity must be interpreted as the range (or diversity) of the

geological, geomorphological and soil attributes, as well as their interaction, systems and processes (Sharples, 2002).

In this context, the objectives of a program of conservation and promotion of sites of geological interest began to be developed: "*The idea behind the initiative is that true sustainable territorial development can be achieved through the protection and promotion of geological heritage through scientific, educational and tourism activities*" (Zourous, 2004).

In 1997, during the 29th General Conference of UNESCO held in Paris, the idea of creating a global network of sites of geological relevance was raised for the first time and was referred into the UNESCO's official document 29 C/5, section II.4.2 (02036).

In April 1999, during the 156th session of UNESCO, was formally proposed for the first time the "UNESCO Geoparks Program" as a new initiative to promote a global network of geoparks, with the objective of safeguarding and developing areas selected for their significant geological features. In this meeting stands out some main topics (UNESCO, 1999):

- The Division of Earth Sciences takes the initiative to coordinate and combine the different national and international efforts in favor of geoconservation and the identification of geosites, as well as to prepare the scenario for future activities in geological heritage conservation and the possibility of establishing a geoparks program under the auspices of UNESCO;
- Is recognized the need to highlight and disseminate the value of geological heritage through representative examples under a sustainable local development approach in both developing and developed countries;
- The Geoparks Program will constitute a complementary activity to the International Geological Correlation Program that focuses on Earth science research;
- To promote the preservation and international recognition of geological heritage by the geoparks program it is not covered by another UNESCO program, nor by any other conservation program. The launch of the Geoparks Program will provide excellent means for the international recognition of sites of geological interest. Considering the different objectives of the World Heritage Convention and the Global Network of Biosphere Reserves, the Geoparks Program will constitute a complementary activity for the preservation of the natural and cultural heritage;
- A geopark will be an area dedicated to highlight the geological features that stand out for their meaning, rarity or beauty, and that are representative of the geological history of a particular area;
- A geopark, in addition to the possibilities of conducting scientific research and environmental education, must have a high potential for sustainable local development, must generate jobs and new economic activities linked to the specific theme of the geopark;
- Every geopark that submits its candidacy to UNESCO must present a management structure and management plan in a context of sustainable development.

The conclusions of that meeting included the proposal of the Geoparks Program in document 30 C/5 (UNESCO's program and budget for the biennium 2000–2001), under the existing structures of the UNESCO International Geological Correlation Program. In this document, within the section on the main actions to promote the management of the terrestrial system, consideration was given to the possibility of creating a UNESCO Geoparks Program within the strategies for the year 2000–2001. At the same time, was suggested a feasibility study in the development of a UNESCO Geoparks Program, in order to improve the international recognition of sites with geological interest to promote the conservation of the Earth's heritage (UNESCO, 2000).

In 2000, the European Geoparks Network (EGN) was founded with the participation of four territories with a significant geological heritage: the Geological Reserve of Haute-Provence (France); the Petrified Forest of Lesbos (Greece); Vulkaneifel (Germany); and Cultural Park of Maestrazgo (Spain).

In April 2001, in the Cabo de Gata-Nijar Natural Park (Spain), during the meeting for the "Management of protected natural spaces and sustainable development", the EGN signed a formal validation agreement with the Earth Sciences Division of UNESCO (referred to in document 161 EX/Decisions, 3.3.1), which established the bases of collaboration between the EGN and UNESCO. Nowadays the EGN is formed by 75 Geoparks in 25 countries.

In February 2004, an international group of UNESCO experts, meet in Paris, agreed on the establishment of the Global Geoparks Network, which included at this time 17 European Geoparks and 8 Chinese Geoparks. In June of the same year, during the First International Geoparks Conference held in Beijing (China), the Global Geoparks Network (GGN) under the auspices of UNESCO was formally established. The GGN is an international organization committed to the conservation, management and communication of the Earth's heritage. Today the GGN counts with 147 Geoparks.

More recently, during the 38th General Conference of UNESCO (November 2015), the 195 UNESCO Member States approved unanimously the International Geoscience and Geoparks Programme (IGGP). This ratified the UGGps as the most recent and innovative territories that promotes sustainable development in a holistic perspective, considering education, local development, scientific research, protection and promotion of natural and cultural heritage (UNESCO, 2016a).

Regarding this new reality, UNESCO established the following guidelines that any Geopark should accomplish to become a UGGp (UNESCO, 2016b):

1. Must be single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education, research and sustainable development.
2. UGG should use that heritage, in connection with all other aspects of that area's natural and cultural heritage, to promote awareness of key issues facing society in the context of the dynamic planet we all live on.
3. UGG should be areas with a management body having legal existence recognized under national legislation.

4. In the case where an applying area overlaps with another UNESCO designated site, such as a WHS or MAB, the request must be clearly justified, and evidence must be provided for how UGG status will add value by being both independently branded and in synergy with the other designations.
5. UGG should actively involve local communities and indigenous peoples as key stakeholders in the Geopark. In partnership with local communities, a co-management plan needs to be drafted and implemented in accordance with the social and economic needs of local populations, looking forward the protection of the landscape in which they live and conserves their cultural identity.
6. UGG are encouraged to share their experience and advice and to undertake joint projects within the Global Geoparks Network Association (GGNa). Membership of GGNa is obligatory.
7. A UGG must respect local and national laws relating to the protection of geological heritage. The defining geological heritage sites within a UGG must be legally protected in advance of any application.

In the Latin America and Caribbean (LAC) region, the interest on stablish geoparks started in 2004 and Araripe Global Geopark (Ceará, NE Brazil) was the first one to be formalized in this continental area (Herzog, Sales, & Hillmer, 2008; Piranha, Lama, & Bacci, 2011). Other initiatives appeared in several countries of the LAC region such as Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Mexico, Nicaragua, Peru, Uruguay and Venezuela. Just in 2013 another territory became part of the GGN: the Grutas del Palacio in Uruguay (Pereira, 2013). After this, in 2017, two more territories became part of the UGGps, the Comarca Minera UGGp and the Mixteca Alta UGGp, both in Mexico (Palacio, Rosado-González, & Miranda, 2018). In April 2019 were formalized by UNESCO three new UGGps in LAC: Kültralkua (Chile), Colca y Volcanes de Andagua (Peru) and Imbabura (Ecuador). Despite this, the reality is that more than 50 projects aspiring to be nominated as UGGps in the short and middle-term.

Since 2008, several meetings were carried out in order to consolidate a regional network to promote the establishment of new territories in LAC. The first significant outcome of these meetings were the Araripe Declaration, signed in 2010 in Brazil. This was followed by the Melipeuco Declaration, signed in 2011 in Chile, and the Arequipa Declaration, signed in 2015 in Peru. In these documents was established on one hand the need of promote the creation of more Geoparks in LAC region, on the other hand, was declared the relevance and particularities of the indigenous cultures that are relevant. In order to achieve this goals and territorial sustainability, was also declared the importance of the networking and joint efforts among the UGGps and aspiring territories (Araripe Declaration, 2010; Arequipa Declaration, 2015; Melipeuco Declaration, 2015).

As of 2015, the territories in LAC start a more consistent work in order to consolidate the UGGps and develop new aspiring projects. This implied the application of three new projects from Mexico (Comarca Minera and Mixteca Alta) and Ecuador (Tungurahua). The UNESCO outcome was the approval of the two Mexican territories (May 2017) and a 2 years deferred of the Ecuadorian

territory. In 2016 the territory Colca y Volcanes de Andagua (Peru) applied to become a UGGp but was also deferred. In 2017 five more aspiring projects from LAC applied to UNESCO to became UGGps: Kütralkura (Chile), Imbabura (Ecuador), Chirripo (Costa Rica), Tacaná Volcano (Mexico) and Rio Coco (Nicaragua). The two first ones together with Colca y Volcanes de Andagua (Peru) were approved as UGGps in April 2019.

In 2017, the four UGGps then existing in the region created the Latin America and Caribbean UNESCO Global Geoparks Network (GeoLAC) during the 4th Latin America and Caribbean Symposium of Geoparks in Arequipa (Peru) (Palacio et al., 2018).

Recently, the UNESCO Chair on "Geoparks, Sustainable Regional Development and Healthy Lifestyles", held in the University of Trás-os-Montes e Alto Douro (Portugal), promoted the initiative to create an Observatory for Sustainable Development in the Latin America and Caribbean UGGps. This initiative, currently under construction, aims to be a forum and a platform for divulgation, discussion and networking for experiences and good practices to be shared among the UGGps and aspiring territories in LAC, towards the development of geoconservation, geoeducation and geotourism strategies for sustainability.

## 3 United Nations Agenda 2030 for Sustainable Development and Geotourism

Between 2005 and 2014, under the scope of the Millennium Development Goals, the UN General Assembly declared a "Decade of Education for Sustainable Development (DESD)" with the main goal to create public awareness for the importance of sustainable development taking into account the education plans (UNESCO, 2016c). The DESD emerged with the argument that education is an indispensable element for achieving sustainable development. In this context, the main goal of the DESD was to integrate in all aspects and ways of education, the principles and values of sustainable development through coordinated efforts of several UN agencies, programmes and organizations (UN, 2016a; UNESCO, 2016d).

At the end of the DESD 10 conclusions emerged: (1) Education systems are addressing sustainability issues; (2) Sustainable development agendas and education agendas are converging; (3) Political leadership has proven instrumental; (4) Multi-stakeholder partnerships are particularly effective; (5) Local commitments are growing; (6) Whole-institution approaches help practice ESD; (7) ESD facilitates interactive, learner-driven pedagogies; (8) ESD is being integrated into formal education; (9) Non-formal and informal ESD is increasing; (10) Technical and vocational education and training advances sustainable development (UNESCO, 2014). In this framework, DESD evolves into the Global Action Programme (GAP) on Education for Sustainable Development. This Programme aimed to be the follow-up of the DESD efforts and contribute to the ESD initiatives of the 2030

Agenda (UNESCO, 2016e). The overarching goal of the GAP is "*to generate and scale up action in all levels and areas of education and learning to accelerate progress towards sustainable development*". To achieve this aim, the GAP established as main objectives: (1) to reorient education and learning so that everyone has the opportunity to acquire the knowledge, skills, values and attitudes that empower them to contribute to sustainable development; (2) to strengthen education and learning in all agendas, programmes and activities that promote sustainable development (UNESCO, 2016e).

In continuity, in 2015 was approved the Agenda 2030 for Sustainable Development, which comprises 17 main objectives with 169 goals focused on establishing better life quality for everyone trough adequate practices of development, taking into account the social, economic and environmental sectors. In this sense, the Agenda 2030 emerged like a continuation of the MDGs, mainly focused on sustainable development, especially in the least developed countries (UN, 2016a).

This was the main reason for the implementation of the Agenda 2030, in order to continue the task of the MDGs making an emphasis in the economic, social, and environmental dimensions of sustainable development (UN, 2015, 2016a).

In this context, the Agenda 2030 establishes the following 17 Sustainable Development Goals:

SDG1—End poverty in all its forms everywhere;
SDG2—End hunger, achieve food security and improve nutrition and promote sustainable agriculture;
SDG3—Ensure healthy lives and promote well-being for all at all ages;
SDG4—Ensure inclusive and equality quality education and promote lifelong learning opportunities for all;
SDG5—Achieve gender equality and empower all women and girls;
SDG6—Ensure availability and sustainable management of water and sanitation for all;
SDG7—Ensure access to affordable, reliable, sustainable and modern energy for all;
SDG8—Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;
SDG9—Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;
SDG10—Reduce inequality within and among countries;
SDG11—Make cities and human settlements inclusive, safe, resilient and sustainable;
SDG12—Ensure sustainable consumption and production patterns;
SDG13—Take urgent action to combat climate change and its impacts;
SDG14—Conserve and sustainably use the oceans, seas and marine resources for sustainable development;
SDG15—Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forest, combat desertification, and halt reverse land degradation and halt biodiversity loss;

SDG16—Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels;
SDG17—Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

These 17 goals emerged from three principal attention axes: end poverty, fight inequalities and injustice, tackle climate change; and recognize five important action sectors (5Ps): the people, the planet, the prosperity, the peace and the partnerships (UN, 2015).

The Agenda 2030 also take into account different programmes and initiatives which seek improvements in education, environment, health and wellbeing like the Istanbul Programme of Action for the Least Developed Countries (IPoA), Paris Climate Change Agreement (PA), Addis Ababa Action Agenda (AA), Sendai Framework for Disaster Risk Reduction (SF), Education 2030 Incheon Declaration and Framework for Action (ID), Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets (SPB) (UNESCO, 2015a, 2015b).

The Istanbul Programme of Action for the Least Developed Countries established particular strategies for the special needs of the least developed countries in order to achieve the MDGs and now the SDGs for the 2011–2020 decade; IPoA identify eight priority areas of action: (1) Productive capacity; (2) Agriculture, food security and rural development; (3) Trade; (4) Commodities; (5) Human and social development; (6) Multiple crises and other emerging challenges; (7) Mobilizing financial resources for development and capacity building; (8) Good governance at all levels (UNESCO, 2015b).

The Paris Climate Change Agreement is an international agreement between 193 United Nations Member States to strength efforts to combat climate change trough national commitments focused on reduce global carbon emissions (UN, 2016c).

The Addis Ababa Action Agenda is an agenda of more than 100 concrete measures to enhance global partnership in order to finance practices and investments in sustainable development good practices trough technology, science, innovation, trade and capacity building. This agreement was reached by 193 UN Member States (UN, 2016d).

The Sendai Framework for Disaster Risk Reduction is a 15-year voluntary agreement adopted by UN Member States to reduce disaster risk through partnerships between local governments, private sector and other stakeholders. The SF establish Four Priorities for Action: (1) Understanding disaster risk; (2) Strengthening disaster risk governance to manage disaster risk; (3) Investing in disaster risk reduction for resilience; (4) Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction (UNISDR, 2016).

The Education 2030 Incheon Declaration and Framework for Action overarching goal is to continue the efforts done to reach the second MDG "Accomplish universal primary education" and contribute to reach the fourth SDG "Ensure inclusive and

equitable quality education and promote lifelong learning opportunities for all" (UNESCO, 2016f).

The Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets it is a 10-year plan of actions between Member States to safeguard biodiversity and continued the efforts on awareness the value of biodiversity and their environmental services (CBD, 2016).

In this entire framework, the geotourism, as one of the main axes of the management structure of UGGps, could implement strategies that can contribute to the Agenda 2030, particularly in the SDGs 8, 9, 10, 11 and 15. The geotourism as one of the tourism segments, appeared in the 1990s decade and was originally defined as a educative sustainable tourism on geological sites, mainly quarries and mines, promoting the access trough interpretative trails that allows to conserve these sites (Hose, 1996).

Afterwards, the concept evolved in different ways, until was formally presented and discussed, among GGN, ProGEO and the National Geographic's Center for Sustainable Destinations of National Geographic Society, in 2011 in the Arouca UGGp during the International Congress of Geotourism. In this meeting were stablished that the geotourism is: "*tourism which sustains and enhances the identity of a territory, taking into consideration its geology, environment, culture, aesthetics, heritage and the well-being of its residents. Geological tourism is one of the multiple components of geotourism*" (Arouca Declaration, 2011). In this sense, the geotourism promotion in the UGGps can be a tool for the contribution on strategies for the sustainable development.

## 4 Methodology Proceedings

This work is part of a broader research, currently under development, which aims to characterize the contribution of LAC UGGps for the Agenda 2030 and its 17 ODS. However, this work intends to be focused on the impact of geotourism in the economy, employment, infrastructure development, reduction of inequalities, the creation of sustainable social dynamics, and environmental conservation aspects in four LAC UGGps, in which the main aim is to carry out a specific analysis of the contribution of these territories for SDGs 8, 9, 10, 11 and 15.

In this context, the first step was to identify which of the SDGs targets were more compatible with the objectives of the UGGps. After the selection of the targets (Table 1), indicators were postulated for a survey that was applied to inhabitants of the four territories.

For the SDG 8 were selected seven of the 12 targets; for the SDG 9 were selected five of the eight targets; for the SDG 10 were selected four of the 10 targets; for the SDG 11 were selected five of the 10 targets; and for the SDG 15 were selected three of the 12 targets defined by United Nations (UN, 2015).

The target population of this work resulted from a selection of persons with greater proximity to the UGGps, such as coordination team members, tourism

**Table 1** Targets selected for each SDG

| | Targets selected |
|---|---|
| SDG 8 | 8.1, 8.2, 8.3, 8.5, 8.6, 8.8, 8.9 |
| SDG 9 | 9.1, 9.2, 9.4, 9.5, 9.c |
| SDG 10 | 10.2, 10.3, 10.4, 10.7 |
| SDG 11 | 11.2, 11.3, 11.4, 11.7, 11.c |
| SDG 15 | 15.1, 15.2, 15.3 |

Source: Author's own table

service providers, school principals and teachers, representatives of local companies, artisans, farmers, guides-interpreters, museum and interpretation center managers, among others.

The application of this methodology in each of the LAC UGGps provided information about the inhabitants' perception of how UGGps are contributing to the SDGs, as well as identifying where there is lack of impact. This reality also allowed to identify potential strategies for its implementation in the UGGps, in order to achieve sustainable development according to the needs of the local population.

## 5 Results

During the fieldwork, a total of 367 surveys were applied, of which 94 were in the Araripe UGGp, 86 in the Grutas del Palacio UGGp, 95 in the Comarca Minera UGGp and 92 in the Mixteca Alta UGGp. The results obtained for the UGGps contribution to the 17 SDGs showed that SDGs 5, 10, 11 and 17 are those that have a greater impact on the territories.

On the other hand, regarding the contribution of the LAC UGGps for SDGs 8, 9, 10, 11 and 15, was noticeable that of the four territories studied, Araripe UGGp and Grutas del Palacio UGGp were those that reported more benefits, and the Comarca Minera UGGp was the one that reported the least benefits.

Concerning the contribution of the LAC UGGps for the SDG 8, the Grutas del Palacio UGGp was the territory with more impact, and Comarca Minera UGGp is the one with less impact. About the specific targets of the SDG 8, the four UGGps in LAC demonstrates higher contribution for the target 8.9. Secondly and thirdly targets with more contribution are the 8.1 and 8.2. The target 8.8 was the one with less contribution by the four UGGps. As example of a contribution for this goal can be mentioned the creation of a "geoproduct" label in Grutas del Palacio UGGp. This is a quality certification ascribed to local and sustainable products that aims to help the economic growth through an innovative strategy of promotion of the native culture and products.

Regarding the SDG 9, the Araripe UGGp was the territory with more contribution evidences, followed by Grutas del Palacio UGGp, Mixteca Alta UGGp, and Comarca Minera UGGp. About the specific targets of this goal, was founded out that the target 9.1 was the one with more influence, followed by the targets 9.2, 9.4 and 9.c, respectively (Fig. 1). As example on how the UGGps are contributing to this

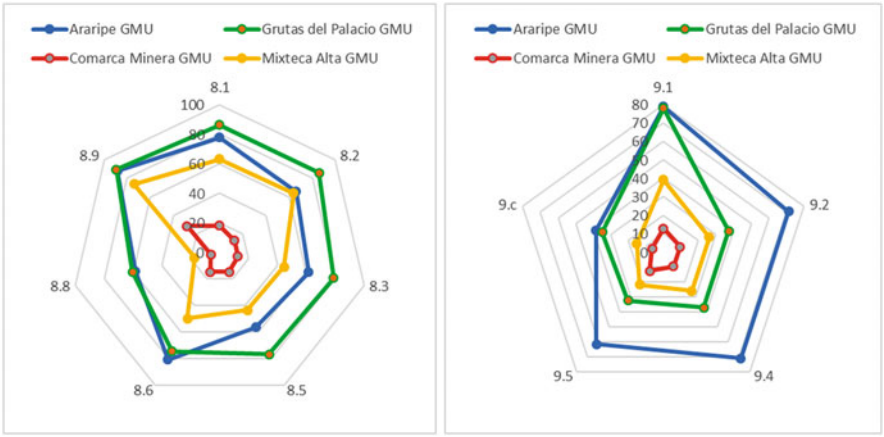


**Fig. 1** Contribution of the four LAC UGGps to the targets chosen from SDG 8. Source: Author's own figure

SDG, the Comarca Minera UGGp created a research laboratory in an old mine, mainly focused on dark matter observation. This laboratory in addition to geophysics research, promotes geotourism through educational activities for science disclosure and allows to visit the geological and cultural heritage linked to the old mine where the laboratory is built. This also promotes scientific research in the region and increase the number of researcher workers.

Concerning SDG 10, Grutas del Palacio UGGp and Araripe UGGp were the territories with more contribution, followed by Mixteca Alta UGGp and Comarca Minera UGGp, respectively. Regarding the contribution in the specific aims, the targets 10.2 and 10.3 were those with highest contribution by the UGGps, followed by the targets 10.4 and 10.7, respectively. In the Araripe UGGp it was possible to find good examples of how the UGGps contribute to the SDG 10 through geotourism. The management structure developed a trail for the disability people—trail of the senses—where disabled persons can experience a trail in full contact with the nature, involving and including them as the most important visitors of this specific area. The Araripe UGGp also contributes to SDG 10 trough different *fora* of discussion and experience sharing with focal groups such as women, artisans, guides and children, among others, in order to support them on their involvement and participation within the community, helping to create a healthier social environment.

Regarding the SDG 11, the Grutas del Palacio UGGp and Araripe UGGp were the ones with more impact, followed by Mixteca Alta UGGp and the Comarca Minera UGGp, respectively. Concerning the impact for the specific targets, the 11.4 was the most relevant in the four territories, followed by the targets 11.7, 11.3, and 11.2, respectively (Fig. 2). In this context, the four LAC UGGps studied have good examples of contribution. Due their initiatives of geotourism they aim to safeguard and conserve the natural and cultural heritage of their territory's trough the promotion of environmental educative activities.

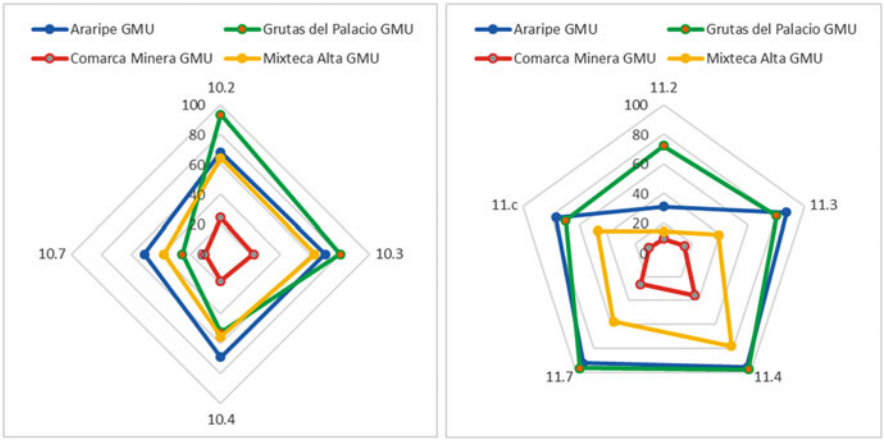


**Fig. 2** Contribution of the four LAC UGGps to the targets chosen from SDG 10. Source: Author's own figure

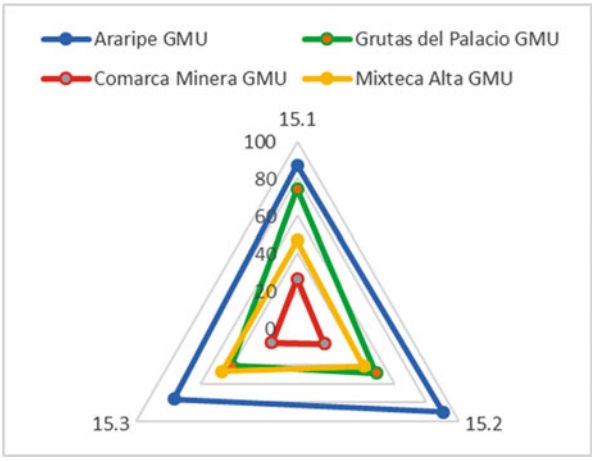


**Fig. 3** Contribution of the four LAC UGGps to the targets chosen from SDG 15. Source: Author's own figure

Concerning to the SDG 15, the Araripe UGGp was the territory with highest contribution, followed by Grutas del Palacio UGGp, Mixteca Alta UGGp, and Comarca Minera UGGp, respectively (Fig. 3). The target for which these territories most contribute is the15.1, followed by 15.2 and 15.3, respectively. One example on how the LAC UGGps contributes to SDG 15, is the case of Mixteca Alta UGGp, where some geotourism activities they had implement, in an innovative strategy to involve the visitors in the communality activities, are related with reforestation, conservation, cleaning of green and natural areas, among others, that aims to restore and protect the environment of the area.

## 6 Discussion and Conclusions

The results processed allowed to discriminate differences and similarities between the four UGGps territories studied. One noteworthy aspect is the evidence the most recent UGGps had less impact on the contribution to SDGs than older ones. Regarding this, it should be noted that the Araripe UGGp reveals a consistent path in this issue, already demonstrating a strong participation of the local community and being possible to observe evident benefits. In contrast, the Comarca Minera UGGp reveals a lower impact and contribution to the SDGs, which demonstrate the efforts to engage and to empower the community for Agenda 2030 sustainable development goals are still at an early stage.

Each UGGps have a management structure, based on different and specific territorial approaches. In the case of the Araripe UGGp and Mixteca Alta UGGp, their management bodies are based on the university's researchers, students and technical teams. On the other hand, the Grutas del Palacio UGGp and Comarca Minera UGGp management structures are based on regional governments. This difference has impacts on the way the UGGps are impacting in the territories and dealing with the implementation of sustainable development practices.

In this sense, the way on how they implement geotourism strategies have different approaches, some of them focused on educational activities, others focused on the community involvement, but all of them with the common goal of contribute decisively for sustainable development.

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