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Case Report

Fernando de Noronha Archipelago (Brazil): A Coastal Geopark Proposal to Foster the Local Economy, Tourism and Sustainability

Jasmine Cardozo Moreira [1,*], Tatiane Ferrari do Vale [2] and Robert Clyde Burns [3]

[1] Tourism Department, Ponta Grossa State University, Ponta Grossa 84010-330, Brazil
[2] Natural Areas Tourism Laboratory, Speleological Research University, Ponta Grossa 84100-000, Brazil; tatianefdovale@gmail.com
[3] School of Natural Resources, West Virginia University, Morgantown, WV 26506, USA; Robert.Burns@mail.wvu.edu
* Correspondence: jasmine@uepg.br

Abstract: Coastal zones across the world are often listed as protected areas as a result of their sensitive ecosystems and frequent social uses. One category of protected area that allows for protection and use is a geopark. A geopark combines geological heritage conservation with sustainable development and must include meaningful geological characteristics, and scientific content. Geoparks can stimulate the coastal economy through the appreciation of the heritage and development of sustainable tourism, along with environmental protection and interpretation. There are geoparks on islands and coastal areas in many continents. Fernando de Noronha archipelago (Brazil), has relevant geodiversity and the potential to join the Global Geoparks Network (GGN). For the creation of a geopark, it is important to acknowledge its geological heritage and relevance. This has already been done in Fernando de Noronha by the Geological Service of Brazil (CPRM), through the identification of the geosites in the island. The goal of this case study is to present actions that have been carried out and that may help on the report development for the proposed Geopark, as well as present the benefits that a geopark can bring to a coastal area. Opportunities for improving the economy with geoproducts and geofood are presented.

Keywords: geopark; Fernando de Noronha Archipelago; geosites; coastal zone; Brazil

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1. Introduction

UNESCO Global Geoparks are unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development [1] (UNESCO, 2021). A geopark must have defined boundaries, meaningful geological scientific value and embrace aspects related to biodiversity, archeology, history, culture, and others [2] (UNESCO, 2007).

The proposed Geopark requires a comprehensive understanding of the Blue Economy across the dynamic networks of human uses, ecosystem understanding, economic valuation, and cultural relationships. Marine protected areas are superb settings for Geoparks, as they are, by design, focused geographic areas that require convergence of science, management, and cultural understanding. There is a critical need to understand the linkages between cultures, communities, and the ocean resources they may interact with as it helps define pathways of sustainability for the economics of coastal communities. Additionally, cultural connections to ocean resources may transcend immediate economics in some settings and create avenues for convergence of sustainable utilization and education into the future. The proposed Geopark would create a sustained partnership among academics, agencies, industry, and public groups to conduct research on the identification of convergence across the intersecting domains and put that into practice in the form of data, services, and processes that would benefit society in the form of pathways into and through the Blue Economy. This process will benefit society as the scale of output will cut across

domains that are rarely intersected, and provide simplified cause-and-effect pathways within the Blue Economy for researchers, resource managers, and the public alike.

As of 2021, the Global Network includes 161 geoparks across 44 countries [1]. Brazil has only one geopark in the network, the Araripe Geopark, in Ceará state, which was designated in 2006. Most of the Global Geoparks are found in Asia and Europe, however, there has been an increase in members from the Americas and Africa in recent years.

Fernando de Noronha is a Brazilian archipelago with internationally recognized beaches, a fortress and other historic monuments, and endemic species of fauna and flora. Volcanic aspects are evident across the landscape, and tourism is the main source of economic income for the islanders [3]. Snorkeling and SCUBA diving are popular recreational activities on the island.

Myriad previous research suggests the archipelago has the potential to be designated as a UNESCO Global Geopark Network—GGN [4–7]. In addition to a geological heritage inventory, previous research [8–10] identified potential in other aspects, such as geotourism [11] and the ongoing use of geosites for tourism activities and land management, as well as island sustainability [12].

For a geopark to join the GGN, the geological heritage and relevance must be addressed. In 2006, the Geological Service of Brazil (CPRM) created the Geopark Project of Brazil [13], and Fernando de Noronha was one of the candidates proposed in the Project. A technical report was developed that identified, described, quantified, and qualified 26 geosites on land. These geosites represent the base for the proposition of the Geopark [5].

The presence of geosites alone is not enough to join the GGN; the territory must already be serving the role of a geopark when submitting the application to UNESCO. A "Self-Evaluation Checklist" describes the actions that need to be taken, and UNESCO evaluators must visit the area to verify if it is following the requested guidelines [14]. This paper presents actions that were taken and will help on the report development of the proposal for Fernando de Noronha Geopark.

The methodology applied was bibliographic, participative observation (in dives and trails), and on-site visits. This research was developed within the confines of Brazilian federal protected areas; therefore, it was registered on the Brazilian research platform named SISBIO, linked to Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio). The paper presents a brief general overview of the archipelago. Then, it describes the actions that were taken to make the UNESCO candidature possible and the economic benefits of a geopark. Finally, the final considerations are presented.

2. Study Area: Fernando de Noronha Archipelago

The archipelago is of volcanic origin and includes 21 islands and cliffs, with a total area of 26 km^2. The main island (11 km in length and 3 km wide) is the only one populated by humans. It is located 545 km from the capital of Pernambuco state, Recife, (Figure 1) and it is formed by the main island (also known as Fernando de Noronha), and the secondary islands: Cuscuz, Rasa, São Jose, Sela Gineta, do Meio, and Rata. Access is by boat or plane, in daily flights.

The archipelago includes two protected areas. The Fernando de Noronha Marine National Park, created in 1988, embraces 70% of the main island and all other islands. It is fundamental for the protection of the scenic beauty of the archipelago, bird-fauna, marine fauna, and especially sea turtles, dolphins, and corals. It was created for public use, education, scientific research, and to protect sites with historic-cultural value [15]. There are guidelines, such as restricted diving in certain areas, mandatory guided tours on trails, operating hours, and restricted visitation to certain beaches and geological monuments. The second protected area is the Environmental Protection Area of Fernando de Noronha—Rocas—São Pedro and São Paulo. The area was designated as a protected area in 1986 and includes the populated area of the archipelago and commercial activities (inns, restaurants, shops, tour agencies, diving agencies, etc.) across 30% of the main island area.

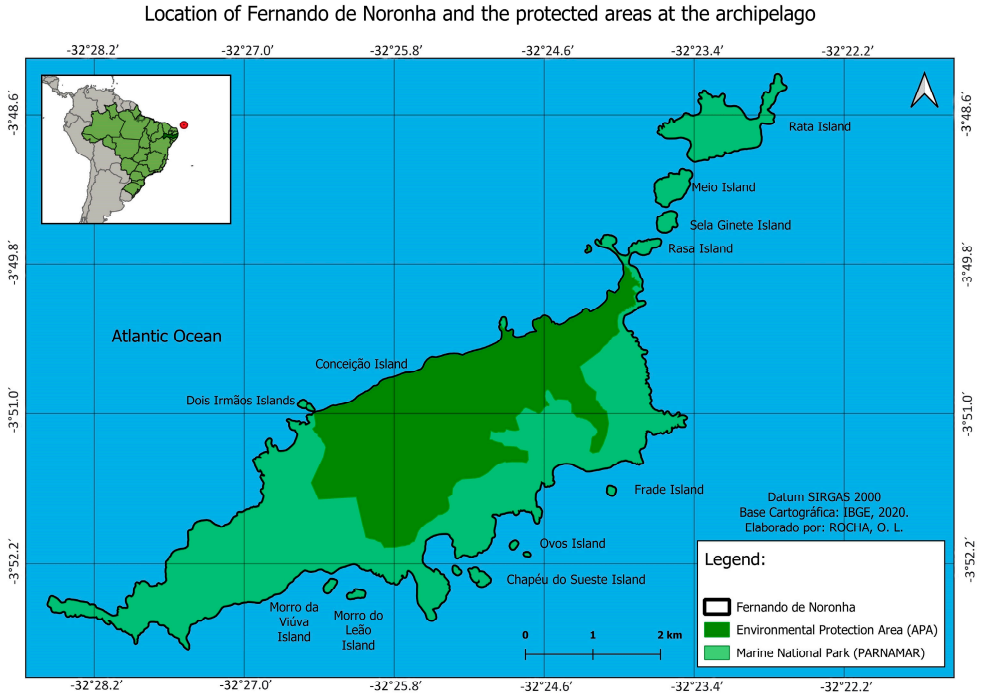

Figure 1. Location of Fernando de Noronha archipelago and the protected areas at the Archipelago, the National Marine Park (in light green), and the Environmental Protected Area (in green).

Fernando de Noronha is known to possess some of the most beautiful beaches of Brazil and the world [16]. For example, Sancho Beach has crystal clear water with tones of blue and green, a great diversity of marine fauna, and high-quality snorkeling opportunities. Access is by the sea or a stairway that traverses down a cliff to the landscape. The other, Lion Beach, is so-named because the Lion's Hill Island looks like a sea lion laying on sand. As it is part of the National Park, access to the beach is restricted between 6 p.m. and 6 a.m.

The park is managed by the ICMBio and by the public concession Econoronha S/A, and visitation permits are valid for 10 days. The concession developed information stations at Sueste Beach and Sancho Beach, with a parking lot, restrooms, shop, coffee shop, lockers, and diving rental equipment. In a recent visitor profile study [17], it was observed that swimming was the predominant recreation activity (91%), followed closely by hiking (80%) and wildlife viewing (80%).

Fernando de Noronha has many historic monuments including military facilities. Numerous military invasions occurred on the island because of its strategic location central to navigation routes from Africa and Europe. These invasions eventually resulted in archeological and cultural heritage, and the island was used as a prison for over 200 years. The vegetation is primarily shrubs and herbaceous with many invasive species. In addition, the archipelago is important for the reproduction of sea birds and it is a nursery for cetaceans and chelonians [15].

The Tamar Project Visitor Center offers free talks each evening to create awareness in visitors and the community. The educational topics are sharks, sea turtles, dolphins, National Park, ecotourism, and others [18]. The area also hosts the Sea Turtle Outdoor Museum, with life-size fiberglass replicas of the five species of sea turtles found in Brazil. As an interpretive, educational environment and local development provider, the Visitor Center and the Museum are now part of the tourism product of Fernando de Noronha [19].

Another of the island's educational offerings is the Shark Museum, where a series of interpretive signs discuss wave patterns and ocean currents and their role on the island. The Noronha Memorial "Américo Vespúcio Cultural Space" also includes educational interpretive signage focusing on geologic and geomorphologic aspects of the archipelago.

Combined, all of the interpretive heritage signage and information support the proposal for Noronha to become a geopark.

The archipelago is what remains of a large volcanic structure, with a base four thousand meters deep, a diameter of 70 km, and is two and a half times bigger than Mount Etna, in Italy [20,21]. Many of the summits have been eroded by wind and sea breeze, and are currently covered by biogenic limestone less than 100 m deep [22]. The archipelago includes volcanic rocks from the Miocene and Pliocene period [23]. The base of the marine elevation has a circumference of approximately two hundred kilometers, which has been formed and modified over time due to erosion and variation in sea levels [16].

A sustainability program (Programa Noronha + 20) was created by the community in 2010. The corresponding document defines the goals and strategies for the sustainable development of the island for a 20 year period, focusing on tourism on the archipelago [24]. The sustainability of the island tourism destinations remains a challenge for managers. Because of specific characteristics, such as isolation and vulnerability, island resource managers continually need to outline strategies to reduce negative impacts from economic activities that are being developed in these places [12].

3. The Proposal to Create Fernando de Noronha Geopark

The Geological Service in Brazil (CPRM) recognizes the importance of geotourism, geoconservation, educational purposes, and scientific research in the area. The implementation of a geopark in Fernando de Noronha would be a contribution to the consolidation of the geotourism as a sustainable activity and would also be an economic alternative for the population that lives in the area. Actions that protect the geological heritage may be ensured by managers in the geopark in collaboration with the geological services, universities, and other important institutions [5] (p. 321).

A recent geological study resulted in the identification of 26 geosites in the area [5]. Of these, 10 geosites are located in the Environmental Protection Area (APA), and 16 in the National Marine Park. Only five of the geosites are closed to visitors. The addition of one more geosite is recommended, "Enseada da Caieira" (Caieira's Cove) (Figure 2). It is suggested because of its geological aspects and beautiful scenery [4]. Remédios and Quixaba Formations can be found in this area, with unique educational and scientific value. In this small area, there are 14 different types of eruptive rocks, ranging from basic to intermediate, and it is considered one of the world's premier examples of the magmatic fractionation phenomenon [25] and a great example of the relationship between climate and geology [26]. There are blocks and pebbles from the Quixaba Formation and alkali-trachytes and dykes of the Remédios Formation that create pyroclastic rocks of the same formation.

In addition to terrestrial geosites, the inclusion of 18 marine geosites related to SCUBA was recommended by the management plan. [10], primarily because these areas are open to underwater visitation. In addition to the inventory of Geosites, a geopark must promote actions on geoconservation, geotourism, and education. The following actions were taken to highlight these aspects of the Fernando de Noronha Geopark proposal and the recognition by UNESCO as a Global Geopark.

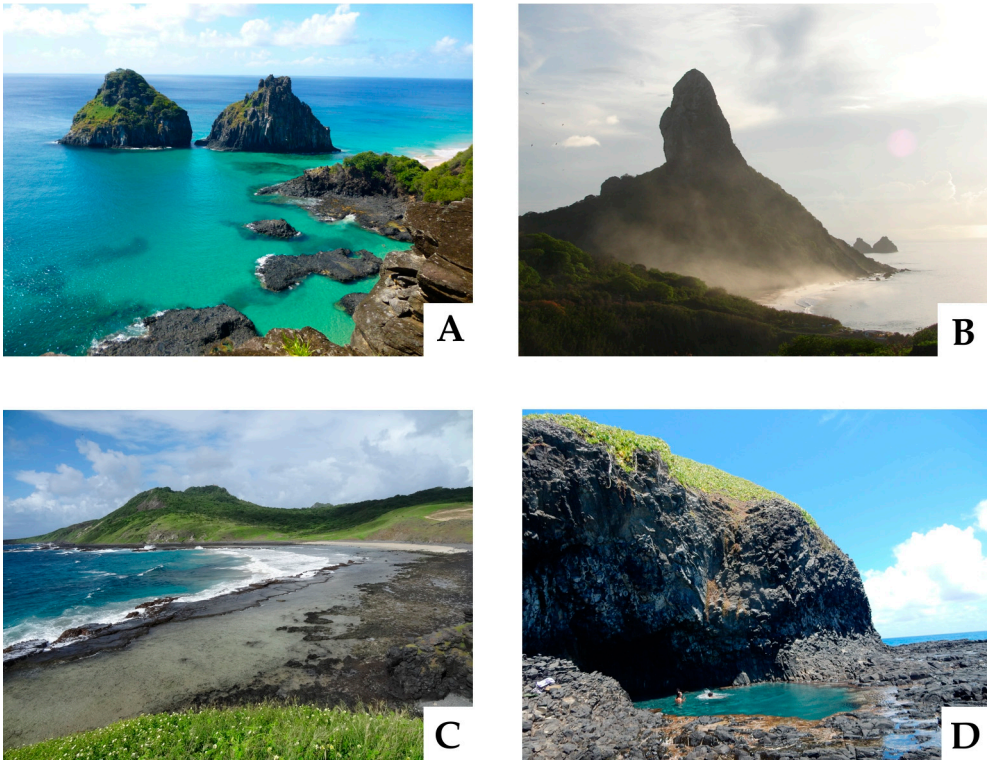

Figure 2. Four geosites of the Fernando de Noronha archipelago. (**A**) Porcos Bay, considered one of the most beautiful beaches in Brazil. (**B**) Peak Hill, the highest peak of the archipelago. (**C**) Caieira's Cove has agglomerates, ashes, and dikes of the Remédios Formation and blocks and pebbles of the Quixaba Formation. (**D**) São José natural pool, located in São José Island. Visiting this geosite is only possible when the tide is low.

- Promotion Actions: Talks, Folders, and Social Media

Free interpretive talks in visitor centers are not common in Brazil, however, Fernando de Noronha has been an example for the country for more than 20 years through the Tamar Foundation/Project visitor center. The talks that involve the geology of the island are important because of the possibility of the geological heritage promotion of the island and community awareness of the geopark proposal. In 2014, a folder for the community was created with information on the geoparks, including definitions, a list with the geosites, and explanations of the geopark proposal. A blog and a Facebook profile were created in 2014, and Instagram and Twitter profiles were created in 2020.

- Guide Training: Geotourism Guiding Course

In 2006, the Golfinho Rotador Center collected data to develop a local community profile in which 300 local residents were interviewed. One of the questions related to tourism asked if the respondents were aware of the geological aspects of the area and if they would be interested in learning more about it. The interest was verified in the interviews and a Geotourism Guiding Course for local guides was created in 2007 [27]. The course topics were geological and geomorphological aspects, geotourism and community involvement, environmental interpretation, and professional ethics.

- Printed Material: Geological Pocket Guide

In 2009, a Geological Pocket Guide was created, focusing on the geological aspects of the archipelago [4]. The guide was created to better understand the geological environment and discusses 23 special sites of interest [28]. Most of these are considered geosites by the CPRM. The guide is available in Portuguese and English, and can be downloaded free on the internet, and can also be found in local stores and museums.

- Presentations at UNESCO Events

The Global Geopark Network recommends that geoparks participate in events promoted by UNESCO, not only for the educational value and networking but also for the promotion of new proposals. Accordingly, papers were presented at European conferences [29–31], Latin American events [32], and worldwide conferences [33,34]. In these events, the members of the Global Geopark Network incorporated new questions and suggestions, such as the identification of marine geosites.

- Geoeducation: "Geoloday"

In order to spread the geological aspects of the island to the students from the local community, the event "Geoloday" was created in 2016. The event partners with the geology department and students from the Minas Gerais Federal University (UFMG), along with other partners. The activities were part of the Environmental Week in the High School of Fernando de Noronha Archipelago (the only school on the island, which has approximately 450 students). This is an example of an important action for the local community that is needed to recognize the importance of their geological heritage [30].

- Creation of a Work Group

In 2013, during an annual council meeting with protected area managers and advisors, a proposal for the approval of the creation of a Work Group to take actions with community participation and to elaborate a dossier was put forth. The interdisciplinary group is integrated with different representative entities to work in an Action Plan. However, as a result of a lack of resources and support for the project, no further research has been conducted in the archipelago.

4. Discussion

4.1. The Benefits of a Geopark

An UNESCO Global Geopark uses its geological heritage, in connection with all other aspects of the area's natural and cultural heritage, to enhance awareness and understanding of the key issues facing society. These include resource sustainably, mitigating the effects of climate change, and reducing natural-disaster-related risks.

In 2015, the 195 UNESCO member states ratified the creation of a new programme: UNESCO Global Geoparks. This shows governmental recognition of the importance of managing outstanding geological sites and landscapes in a holistic manner. There are four features that are fundamental: management, geological heritage of international value, visibility, and networking [1].

A geopark is dissimilar to many existing parks and protected areas—it is a paradigmatic shift in the way of understanding a setting. Being part of the Global Geoparks Network brings international recognition and prestige to the region. It becomes a marketing tool that may promote the region to new visitors, develop business and result in positive economic impacts to the community. Geoparks have educational and interpretive activities with the main objective of educating the visitors and the community.

As suggested by the GGN, a geopark should aim to increase economic development of the region "stimulating economic activities and developing sustainable activities in the local community, boosting the local socioeconomic development through an image of excellent recognized geological heritage, which attracts a large number of visitors" [35] (p. 239).

Geotourism is often the main economic activity in a geopark territory, promoting work opportunities and reducing emigration. [7,36,37]. However, there is an absence of research that focuses on how to achieve economic development in geoparks without outside investors, in other words, being a self-independent territory. Geoparks often adopt a management model that is specific to the local setting, which makes economic benefit analysis complex, and also makes benchmarking with local communities difficult.

One of the ways to create job opportunities is from geoproducts, which are "products that are considered traditional and that are related or inspired by the geodiversity of the

territory" [38]. The sales of geoproducts can promote specialized training for local residents, create new job opportunities, and create awareness in the visitors about the importance of geodiversity.

Another strategy to add value to the geological heritage and local communities is through geofoods, which can be gastronomic souvenirs or special meals related to the local geological heritage, with the potential to promote the creative economy to generate jobs and income [39,40]. The "GEOfood" brand aims to emphasize the authenticity of products, producers, and restaurants inside some of the geoparks [41], and follows a set of guidelines to certify these products [42–44]. There are other products that are not part of the GEOfood project but are effective in providing value to local products and local development.

Georoutes are another attraction of a geopark that can enhance the economy. The creation of georoutes may include the creation of geotrails, visits to geosites, environmental interpretation centers, and sustainable touristic activities in nature. These georoutes may be a new attraction in the territory and can be promoted by guides and local businesses.

Hotels and the gastronomic industry are directly benefited by geopark visitors, as well as other touristic attractions that are not necessarily related to geological aspects, such as museums and parks.

4.2. Geoparks in Coastal Regions

There are many geoparks in coastal regions worldwide. These include Canada (Geoparks Cliffs of Fundy, Percé, and Discovery), Indonesia (Toba Caldera), Ireland (Copper Coast, Burren, and Cliffs of Moher), Norway (Magma, Gea Norvegica, and Trollfjell), Spain (Cabo de Gata, Basque Coast), United Kingdom (English Riviera), Thailand (Satun), among others.

Nine geoparks are located or partially located on islands: Lesvos (in Greece, one of the first Geoparks created in the world), Açores (Portugal), Shetland (United Kingdom), Psilorits (Greece), Langkawi (Malaysia), Batur (Indonesia), Ilhas Oki (Japan), Jeju (Korea), and Hong Kong (China). In some cases, the islands are larger than the geopark itself, as is the case in Sicily (Italy), where they have two geoparks, the Madonie and Roca di Cerere [45]. Other geoparks that are on islands are located in Spain (Lanzarote and Chinijo Islands and El Hierro), Croatia (Vis Archipelago), and Iran (Qeshm). Several geoparks located in coastal areas are part of the GEOfood project, (e.g., Vis Archipelago (Croatia), Magma (Norway), Azores (Portugal), and Qeshm (Iran)).

In coastal, marine, or island areas, activities such as snorkeling and SCUBA diving are important to the local economy and can lead to geodiversity. There are only a few areas that include "marine geo-interpretation" (e.g., the Azores Geopark [46] and Lanzarote and Chinijo Islands Geopark [47]). In Jeju Geopark there are 3D and interactive exhibits that explain the volcanic geology of the island, linked with an artistic interpretation of basaltic rock and the island's folklore. Exhibits like this, associated with printed interpretative publications and guide services fulfill an essential role in raising awareness, understanding, and appreciation of the geological resources [48].

Trails are also an important part of a Geopark and in Jeju, three geotrails were developed, that connect geosites, geopartner shops, and historical and cultural sites on the island. Because the geosites and the geotrails boosted the local economy, local communities requested to develop geosites and geotrails in their districts [49].

Tourism can bring negative impacts that should be avoided. In the Azores archipelago "*the pressure that the increasing development of tourism have been exerting on these geological sites for the last years, and the need to create alternative forms of tourism, which contribute towards the socio-economic development in rural areas, have highlighted the importance of geotourism as a tool to promote and preserve the geological heritage of the Azores. [50] (p. 126)*. Geotourism has turned to be an important instrument of environmental awareness through the local and foreign people". In the same Geopark, the increasing interest in geotourism has prompted the need for quantitative assessments of geosites as a fundamental step in the application of

geoconservation strategies, in order to assure sustainable planning, management, and use of natural resources [51].

At Lesvos Geopark in Greece, the educational aspects are highlighted. Educational activities are available for teachers and students of all ages, in a special program called "I am a Geoparker", to increase the geo-identity of the local residents. At Hong Kong Geopark there are "Hong Kong Geofolks" and "Rock Family", educational tools based on the topics and the geological phenomena that can be seen in the geopark area. They are available for sale for children, but they also appear in brochures for adults [52].

Quite a bit of research and development in geoconservation work has been conducted within the United Kingdom [53,54]. In Brazil, research on this topic has been conducted only on the Fernando de Noronha archipelago, which stands out for its clear water and diversified marine geology [9,10,55,56].

Other islands are also preparing Geopark candidatures. Geoheritage inventory and assessment are therefore the first steps in the process of effective conservation and promotion. On Malta Island, geoheritage combined with the rich cultural heritage could be considered as the heart of tourism and educational activities. Geotourism will ensure benefits for travelers that will discover the geoheritage, cultural heritage, and traditions of the archipelago in an innovative and green way, respecting the environment and ensuring sustainable economic growth [57].

4.3. Next Steps for the Creation of a Geopark in Fernando de Noronha

The creation of a Geopark in Fernando de Noronha can bring economic benefits to the community. The local community can learn more about the geological heritage of the region and recognize its importance on a global level. The environmental interpretation of the geological heritage area is still in an early stage of development, and new local opportunities may arise.

For the preparation of the dossier and the application to UNESCO, other activities and management actions are still necessary. One possibility is the assistance in management from the Golfinho Rotador Center. Without the community, there is no geopark. The support from the community is fundamental for success, such as for the management and for the execution of activities. The Work Group plans the creation of an event about the topic for the community, where researchers and management representatives from the Brazilian Geological Service can clarify questions and doubts about the project. The submission to UNESCO will only be made after talking with local residents. Other actions are necessary for funding and the spread of the theme to the community, so another suggestion is the creation of a geotrail [32].

Fernando de Noronha has the potential for geofood and geoproduct development, there are also handicraft products with geological characteristics, such as frames, jewelry, clothes, and others. Many trails have the potential to be defined as geotrails, for example, the Pontinha-Atalaia, São José, and Abreus trails.

5. Conclusions

Fernando de Noronha archipelago has the requirements to join the Global Geopark Network of UNESCO. In one small archipelago, there is world-class geological heritage, but for the creation of a geopark, it is necessary to take other actions that lead to the goals of the initiative. These actions have already started to be developed, but they need to be continued.

Joining the Global Geopark Network requires a commitment. The promotion of this destination will be favored, but it is necessary to take marketing actions, such as events and educational activities. On the other hand, visitors can be provided better quality their visits.

Geoparks look to encourage employment and income growth for local communities, by increasing the value of the geological heritage. Tourism is one of the main activities that can be developed through encompassing geotourism, adventure tourism, ecotourism, cultural tourism, and others.

Many advances were made for the protection of these special locations from the geological point of view in the last decades. In the meantime, it is important for the local socioeconomic development to be aligned with the goals of sustainable tourism. The inclusion, the local communities must be primordial in the recognition process and land management.

Fernando de Noronha is a privileged location for the development of activities in natural areas. In the past years, there has been an excessive growth in tourism demand. Which might be damaging the quality of life of the islanders and the experience of the visitor, who may deal with long waiting lines and crowded attractions. It is important to reconcile the search for socioeconomic development with the negative impacts caused by tourism.

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References

1. UNESCO Global Geoparks. Available online: http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/ (accessed on 15 January 2021).
2. UNESCO. *Guidelines and Criteria for National Geoparks Seeking UNESCO's Assistance to join the Global Geoparks Network*; UNESCO: Paris, France, 2007.
3. Teixeira, W.; Cordani, U.G.; Menor, E.A.; Teixeira, M.G.; Linsker, R. *Arquipélago Fernando de Noronha: O Paraíso do Vulcão*, 1st ed.; Terra Virgem: São Paulo, Brazil, 2003.
4. Moreira, J.C. Patrimônio Geológico em Unidades de Conservação: Atividades Interpretativas, Educativas e Geoturísticas. Ph.D. Thesis, Universidade Federal de Santa Catarina, Florianópolis, Brazil, 8 December 2008.
5. Wildner, W.; Ferreira, R.V. Geopark Fernando de Noronha—PE—Proposta. In *Geoparques do Brasil—Propostas*, 1st ed.; Schobbenhaus, C., Silva, C.R., Eds.; Serviço Geológico do Brasil—CPRM: Rio de Janeiro, Brazil, 2012; Volume 1, pp. 317–360.
6. Moreira, J.C.; Guimarães, G.B. Fernando de Noronha Archipelago: A Paradise Formed by Volcanism in Brazil. In *Volcanic Tourist Destinations*, 1st ed.; Erfurt-Cooper, P., Ed.; Springer: Berlin, Germany, 2014; Volume 1, pp. 315–323. [CrossRef]
7. Vale, T.F. A gestão do Território e os Benefícios de um Geopark: Ações Visando a Implantação do Projeto Geopark Fernando de Noronha (PE). Master's Thesis, Universidade Estadual de Ponta Grossa, Ponta Grossa, Brazil, 10 April 2017.
8. Moreira, J.C.; Medeiros, P.; Robles, R.A.; Raub, A.S. Os Benefícios de um Geopark e a Proposta de um Geopark em Fernando de Noronha. In *Anais do Encontro de Pesquisa de Fernando de Noronha, São Pedro e São Paulo e Atol das Rocas, Fernando de Noronha, PE, Brasil, 1. 2016*; ICMBio: Fernando de Noronha, Brasil, 2016.
9. Moreira, J.C.; Silva-Júnior, J.M. Trilhas Subaquáticas em Fernando de Noronha—PE: A Importância da Interpretação Ambiental Relacionada a Geodiversidade. In Proceedings of the Anais do 2 Congresso Nacional de Planejamento e Manejo de Trilhas/I Colóquio Brasileiro para a Red Latinoamericana de Senderismo, Rio de Janeiro, Brasil, 10–13 October 2013; pp. 1203–1219.
10. Moreira, J.C.; Silva-Júnior, J.M. Proposta de Geosítios Marinhos do Projeto Geopark Aspirante de Fernando de Noronha e a Importância da Interpretação Ambiental Relacionada a Geodiversidade. In *Anais do Encontro de Pesquisa de Fernando de Noronha, São Pedro e São Paulo e Atol das Rocas, Fernando de Noronha, 1–3 September 2015, Brasil*; ICMBio: Fernando de Noronha, Brazil, 2016; pp. 201–214.
11. Moreira, J.C.; Bigarella, J.J. Geotourism and Geoparks in Brazil. In *Global Geotourism Perspectives*, 1st ed.; Dowling, R.K., Newsome, D., Eds.; Goodfellow Publishers: London, UK, 2010; pp. 3–15. [CrossRef]
12. Vale, T.F.; Moreira, J.C. A Gestão do território e a sustentabilidade nos arquipélago de Fernando de Noronha (Brasil) e Açores (Portugal). *OLAM Ciênc. Tecnol.* **2017**, *1*, 52–75.

13. CPRM. Propostas de Geoparques. Available online: http://www.cprm.gov.br/publique/Gestao-Territorial/Gestao-Territorial/Propostas-de-Geoparques---Projeto-Geoparques-5416.html (accessed on 18 March 2019).
14. UNESCO. Self-Evaluation Checklist for Aspiring UNESCO Global Geoparks (aUGGp). Available online: https://en.unesco.org/sites/default/files/checklist_vf.pdf (accessed on 18 April 2021).
15. Ibama; PNUD; Tetraplan. *Plano de Manejo APA Fernando de Noronha—Rocas—São Pedro e São Paulo*; Ibama: Fernando de Noronha, Brazil, 2005.
16. Tripadvisor.com: About Trip Advisor. Available online: http://www.tripadvisor.com/TravelersChoice-Beaches-cTop-g1 (accessed on 20 January 2021).
17. Moreira, J.C.; Haura, F.K.; Burns, R.C.; Caires, A.M. Perfil, Percepção dos Visitantes e a Observação de Animais Silvestre: Estudo de Caso do Parque Nacional Marinho de Fernando de Noronha—PE. *Rev. Anais Bras. Est. Tur. ABET* **2019**, *9*, 1–13. [CrossRef]
18. Moreira, J.C.; Robles, R.A.; Bellini, C. As palestras como meio interpretativo: Estudo de Caso com palestrantes em Fernando de Noronha—PE. *Rev. Bras. Ecotur.* **2009**, *2*, 322.
19. Moreira, J.C.; Robles, R.A. Tamar Project: Conservation and Education in Ecotourism Activities Related to Turtles in Fernando de Noronha Archipelago, Brazil. In *Wildlife Tourism, Environmental Learning and Ethical Encounters*, 1st ed.; Borges de Lima, I., Green, R., Eds.; Springer: Cham, Switzerland, 2017; pp. 169–181. [CrossRef]
20. Almeida, F.F.M. *Geologia e Petrologia do Arquipélago de Fernando de Noronha*; DNPM/DGM: Rio de Janeiro, Brazil, 1955.
21. Cordani, U.G.; Ulbrich, M.N.; Menor, E.A.; Lopes, R.P. Cenozoic Alkaline Volcanism of Fernando de Noronha Island. In *Field Trip Guide of the 4th South American Symposium on Isotope Geology*; Companhia Baiana de Pesquisa Mineral—CBPM/IRD: Salvador, Brazil, 2003; pp. 1–24.
22. Almeida, F.F.M. Ilhas Oceânicas Brasileiras e Suas Relações com a Tectônica Atlântica. *Terrae Didática* **2006**, *2*, 3–18. [CrossRef]
23. Almeida, F.F.M. Arquipélago de Fernando de Noronha. In *Sítios Geológicos e Paleontológicos do Brasil*, 1st ed.; Schobbenhaus, C., Campos, D.A., Queiroz, E.T., Winge, M., Berbert-Born, M., Eds.; DNPM: Brasília, Brazil, 2002; Volume 1, pp. 361–368.
24. Zanirato, S.H.; Tomazzoni, E.L. A sustentabilidade do turismo em Fernando de Noronha (PE-Brasil). *Turydes Revista Turismo y Desarrollo Local* **2014**, *7*, 1–24.
25. Santos, A.; Jodar, J.M.; Menor, E.A. The Fernando de Noronha Archipelago: Presentation of the Geological Heritage. In *Towards the Balanced Management and Conservation of the Geological Heritage in the New Millenium*; Barretino, D., Vallejo, M., Gallego, E., Eds.; Sociedad Geologica de Espana: Madrid, Spain, 1999; pp. 214–218.
26. Ibama & Funatura. *Plano de Manejo do Parque Nacional Marinho de Fernando de Noronha–P*; Ibama: Brasília, Brazil, 1990.
27. Moreira, J.C.; Bigarella, J.J. The Geotourism Guide Training at the Fernando de Noronha Archipelago—Brazil. In Proceedings of the Inaugural Global Geotourism Conference, Fremantle, Austrália, 17–20 August 2008; p. 457.
28. Moreira, J.C. *Guia Geológico de Fernando de Noronha*; Nícia Guerriero Edições: São Paulo, Brazil, 2009.
29. Moreira, J.C. Stimulating a Geopark proposal in Fenando de Noronha Archipelago—Brazil. In Proceedings of the 11 European Geoparks Conference, Arouca, Portugal, 19–21 September 2012; EGN: Arouca, Portugal, 2012; pp. 203–204.
30. Vilela, F.T.; Moreira, J.C.; Costa, A.G.; Silva-Júnior, J.M. Geoloday—The dissemination of geological aspects to Fernando de Noronha community–Brazil. In Proceedings of the 14 European Geoparks Conference, Ponta Delgada, Azores, Portugal, 7–9 September 2017; Azores Geopark: Ponta Delgada, Portugal, 2017; p. 186.
31. Vale, T.F.; Moreira, J.C. Volcanic islands and environmental interpretation: An analysis between Fernando de Noronha Geopark Project (Brazil) and Geopark Azores (Portugal). In Proceedings of the 14 European Geoparks Conference, Ponta Delgada, Azores, Portugal, 7–9 September 2017; Azores Geopark: Ponta Delgada, Portugal, 2017; p. 191.
32. Moreira, J.C.; Robles, R.A.; Araújo, R. Fernando de Noronha: Proposta de Geopark a ser Decidida Pela Comunidade. In Proceedings of the Actas do III Encuentro Latino-Americano de Geoparks, San Martin de los Andes, Argentina, 25–27 November 2013.
33. Moreira, J.C.; Robles, R.A.; Rodrigues, G. Fernando de Noronha Aspiring Geopark Project (Brazil): History, Culture and Tourism. In Proceedings of the Abstracts of the 6th International UNESCO Conference on Global, Saint John, NB, Canadá, 19–22 September 2014; Stonnehammer Geopark: Saint John, NB, Canada, 2014; pp. 60–61.
34. Moreira, J.C.; Silva-Júnior, J.M. Underwater Trails at Fernando de Noronha Aspiring Geopark Project (Brazil): Marine Geosites and the Importance of the Environmental Interpretation Related with the Geodiversity. In Proceedings of the Abstract Book of the 7th International Conference on UNESCO Global Geoparks, Torquay, England, 27–30 September 2016; English Riviera Geopark: Torquay, UK, 2016; p. 73.
35. Lima, E.A.; Nunes, J.C.; Costa, M.P. Geoparque Açores Como Motor de Desenvolvimento Local e Regional. In Proceedings of the Livro de Resumos–15 Congresso da Associação portuguesa de Desenvolvimento Regional, 2 Congresso Lusófono de Ciência Regional, 3 Congresso de Gestão e Conservação da Natureza e 1 Congresso de Desenvolvimento Regional de Cabo Verde, Cidade da Praia, Cabo Verde, 6–11 July 2009.
36. Farsani, N.T.; Coelho, C.; Costa, C. Geotourism and geoparks as novel strategies for socio-economic development in rural areas. *Int. J. Tour. Res.* **2011**, *13*, 68–81. [CrossRef]
37. Álvarez, R.F. Geoparks and education: UNESCO Global Geopark Villuercas-Ibores-Jara as a case study in Spain. *Geosciences* **2020**, *10*, 27. [CrossRef]
38. Rodrigues, J.; de Carvalho, C.N.; Ramos, M.; Ramos, R.; Vinagre, A.; Vinagre, H. Geoproducts–Innovative development strategies in UNESCO Geoparks: Concept, implementation methodology, and case studies from Naturtejo Global Geopark, Portugal. *Int. J. Geoherit. Parks* **2020**, *9*, 108–128. [CrossRef]

39. Vale, T.F.; Moreira, J.C.; Horodyski, G.S. Geo-food: Uma nova perspectiva de preservação do patrimônio geológico. In Proceedings of the Anais do 13o Encontro Nacional de Turismo de Base Local, Juiz de Fora, Brazil, 10–13 November 2014; Universidade Federal de Juiz de Fora: Juiz de Fora, Brazil, 2014; pp. 167–179.
40. Vale, T.F.; Moreira, J.C.; Horodyski, G.S. GEOFOOD: A produção de alimentos regionais fomentando a economia criativa. In *Alimentação e Sustentabilidade*, 1st ed.; Vilani, R.M., Vanzela, E., Brambilla, A., Eds.; Editora do CCTA: João Pessoa, Brazil, 2019; pp. 267–296.
41. Gentilini, S.; Skogen, C.; Thjømøe, P. The GEOfood brand: Local and International cooperation. *Eur. Geoparks Netw. Mag.* **2020**, *17*, 26.
42. Thjømøe, P.; Gentilini, S. Developing local menus: The GEOfood project. In Proceedings of the Abstracts of the 6th International UNESCO Conference on Global, Saint John, NB, Canadá, 19–22 September 2014; Stonnehammer Geopark: Saint John, NB, Canada, 2014; p. 89.
43. Gentilini, S.; Thjømøe, P. Local food certifications in Geoparks. In Proceedings of the European Geoparks Conference Abstracts Book, Rokua Geopark, Finland, 3–6 September 2015; Rokua Geopark: Rokua, Finland, 2015; p. 37.
44. Gentilini, S.; Thjømøe, P. Engaging local food SME's. In Proceedings of the Abstract Book of the 7th International Conference on UNESCO Global Geoparks, Torquay, England, 27–30 September 2016; English Riviera Geopark: Torquay, UK, 2016; p. 176.
45. Vale, T.F.; Moreira, J.C. O Arquipélago de Fernando de Noronha e os Geoparks Insulares: Uma Análise das Atividades de Turismo em Áreas Naturais. In Proceedings of the Anais do 3o Simpósio Brasileiro de Patrimônio Geológico, Lençois, Brazil, 8–13 September 2015; pp. 313–316.
46. Lima, E.A.; Machado, M.; Guerreiro, M.; Nunes, J.C.; Costa, M.P. Geological heritage management in small islands: The example of the Azores UNESCO Global Geopark (Portugal). *Geoheritage* **2018**, *10*, 659–671. [CrossRef]
47. Galindo, I.; Romero, C.; Llorente, M.; Rubio, J.C.; Sánchez, N.; Martín-González, E.; Mangas, J.; Vegas, J. Geoheritage in the Shallow Submarine Slopes of an Oceanic Volcanic Edifice: A New Option for Diving Geotourism. In *Lanzarote and Chinijo Islands Geopark: From Earth to Space*, 1st ed.; Wolfgang, E.F., Bobrowsky, P.T., Martinez-Frias, J., Eds.; Springer: Cham, Switzerland, 2019; pp. 85–98. [CrossRef]
48. Crofts, R.; Gordon, J.E.; Brilha, J.; Gray, M.; Gunn, J.; Larwood, J.; Santucci, V.L.; Tormey, D.; Worboys, G.L. *Guidelines for Geoconservation in Protected and Conserved Areas*; IUCN: Gland, Switzerland, 2020. [CrossRef]
49. Lee, Y.; Ramasamy, J. Economic impact of UNESCO global geoparks on local communities in Asia: Comparative analysis of three UNESCO global geoparks in Asia. *Int. J. Geoheritage Parks* **2021**. [CrossRef]
50. Lima, E.A.; Machado, M.; Nunes, J.C. Geotourism development in the Azores archipelago (Portugal) as an environmental awareness tool. *Czech, J. Tour.* **2013**, *2*, 126–142. [CrossRef]
51. Raposo, V.B.; Melo, C.S.; Silva, L.; Ventura, A.; Câmara, R.; Pombo, J.; Johnson, M.E.; Ávila, S.P. Comparing Methods of Evaluation of Geosites: The Fossiliferous Outcrops of Santa Maria Island (Azores, NE Atlantic) as a Case Study for Sustainable Island Tourism. *Sustainability* **2018**, *10*, 3596. [CrossRef]
52. Frey, M.L. Geotourism—Examining Tools for Sustainable Development. *Geosciences* **2021**, *11*, 30. [CrossRef]
53. Burek, C.V.; Ellis, N.V.; Evans, D.H.; Hart, M.B.; Larwood, J.G. Marine geoconservation in the United Kingdom. *Proc. Geol. Assoc.* **2013**, *124*, 581–592. [CrossRef]
54. Gordon, J.E.; Brooks, A.J.; Chaniotis, P.D.; James, B.D.; Kenyon, N.H.; Leslie, A.B.; Long, D.; Rennie, A.F. Progress in marine geoconservation in Scotland's seas: Assessment of key interests and their contribution to Marine Protected Area network planning. *Proc. Geol. Assoc.* **2016**, *127*, 716–737. [CrossRef]
55. Vale, T.F.; Moreira, J.C.; Albani, R.A. Interpretando a geodiversidade: Percepções dos mergulhadores sobre o mergulho autônomo no arquipélago de Fernando de Noronha (Pernambuco, Brasil). In Proceedings of the Anais do Simpósio Brasileiro de Patrimônio Geológico, Araripe Geopark, Crato, Brazil, 14–18 October 2019; Geopark Araripe: Crato, Brazil, 2019.
56. Vale, T.F.; Albani, R.A.; Moreira, J.C. The opinion of divers on the interpretation of marine geology in the archipelago of Fernando de Noronha (Brazil). *J. Geol. Surv. Braz.* **2021**, *4*, 1–8. [CrossRef]
57. Selmi, L.; Coratza, P.; Gauci, R.; Soldati, M. Geoheritage as a Tool for Environmental Management: A Case Study in Northern Malta (Central Mediterranean Sea). *Resources* **2019**, *8*, 168. [CrossRef]