

Importance and characteristics of a waterfall for sustainable tourism with a focus on the binational Colombian-Ecuadorian border

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Abstract: Waterfall tourism can be a source of economic income for local communities, but it is important that it be conducted in a sustainable manner. Promoting responsible tourism implies guaranteeing the conservation of the surrounding ecosystems, respecting established norms, and educating visitors about the importance of protecting these natural areas. In the binational border of Colombia and Ecuador in the last 10 years after the post-conflict process, nature activities have included visits to waterfalls, but there is little information to put into context the importance and characteristics of waterfalls from a landscape approach. In this sense, the present study aimed to analyze the importance of waterfalls in nature tourism and to describe the aspects that characterize and describe a waterfall from a landscape approach. In order to respond to these objectives, a bibliographic review of the scientific literature in databases such as Scopus and Web of Science was used. The main results indicate the ecosystemic and economic importance for the development of sustainable tourism, and that the characteristics to evaluate its scenic beauty should consider physical and anthropic characteristics. Finally, it is essential to focus efforts on evaluating tourists who have previously visited waterfalls so that they can describe and indicate their preferences.

Keywords: Tourism, waterfalls, economics, Amazon, sustainability



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1. Introduction

Tourism encompasses all relationships and phenomena resulting from the change of location and stay of people for a specific purpose related to tourism activities. The present form of tourism could only develop with industrialization, the consequent division of labor and its temporal regulations, as well as the general economic boom that began with it. In the course of general social change in the industrialized countries, leisure and tourism are now firmly anchored in the consciousness of the population as important basic needs and form an essential feature of a wide variety of lifestyles [1,2]. The extremely rapid quantitative growth of tourism after World War II (mass tourism) has made tourism an important economic sector. In the last three decades, only in two specific cases has it not grown, in 2009 due to the global economic crisis and from 2020 to the present due to the COVID-19 pandemic [3-5]. At present, international tourism continues with an accelerated growth, so that between January and March 2022, destinations around the world received three times more arrivals than in 2021 in the same period. Although these figures are encouraging, tourist arrivals remained 61% lower than in the first quarter of 2019, prior to the pandemic. Thus, tourism activities show a recovery, but something important to highlight are the preferences on the type of tourism, it has been evidenced that after the pandemic visitors are more inclined to nature activities [6,7].

Nature tourism is a tourism modality that proposes a closer relationship between nature and its visitors; it also promotes the conservation of the natural and social resources of the area where it is practiced. This modality refers to all activities that can be carried out outdoors in contact with the natural environment and in ecosystems that are as pristine as possible, that is, areas that have not suffered anthropic disturbances that have altered their natural state [8]. Natural areas with some form of protection such as national parks or reserves are very popular destinations for this type of tourism. Important factors when choosing a travel destination are aesthetically attractive landscapes with appealing biological, physical and cultural characteristics [9-12]. This tourism segment is directly related to the sustainable use of natural resources. The World Tourism Organization (UNWTO) in its types of tourism does not describe 'nature tourism' as such, but this segment can include ecotourism, adventure tourism, coastal-maritime and inland water tourism, mountain tourism and in certain cases (activities) rural tourism [13-15].

The basic elements that characterize people who choose nature tourism consist of activities that keep them in constant movement, and in search of meaningful experiences [16,17]. Unlike traditional tourism, in nature tourism, visitors are in search of unique experiences, according to their new tastes, needs and preferences, such as interacting with the host communities and nature, engaging in physically challenging activities, searching for meaningful emotions, keeping fit, taking care of their health, and engaging in outdoor activities [18,19]. One of the basic principles of these types of tourism is the use and enjoyment of its elements in a sustainable manner. When we talk about sustainability within tourism, it means that all activities are developed in harmony

with natural and cultural resources in order to ensure its benefits to future generations, based on three basic axes: environmental, social and economic [1,20,21].

Among the visitors of this segment of nature tourism who enjoy outdoor recreational activities and delight in the scenic beauty of its elements, there is a group dedicated to the search for and enjoyment of waterfalls. In this group of visitors, we can evidence marked preferences regarding their aspects and descriptive elements [22,23]. In this sense, in the process of implementing sustainable management supported by technological tools and marketing strategies, it is possible to strengthen the use of waterfalls as a strategic component in nature tourism [24,25].

Waterfall tourism can be a source of economic income for local communities, but it is important that it be carried out in a sustainable manner. Promoting responsible tourism involves ensuring the conservation of surrounding ecosystems, respecting established regulations, and educating visitors about the importance of protecting these natural areas [26]. Sustainable tourism can also contribute to local development, providing employment and opportunities for economic growth. Conscious tourism practices that preserve the natural beauty of waterfalls and promote long-term sustainability should be encouraged [27–30].

Historically, the importance of waterfalls in tourism has been studied insipidly, and the few studies only describe their use and their increase over time. In this sense, the present study aimed to analyze the importance of waterfalls in nature tourism and to describe the aspects that characterize and describe a waterfall from a landscape approach. In order to respond to these objectives, a bibliographic review of the scientific literature in databases such as Scopus and Web of Science was used.

2. Methodology

In order to respond to the established objectives, the methodological design was exploratory and descriptive, and the tool used in the first instance to describe the importance of waterfalls in nature tourism was a bibliographic review of scientific and gray literature, complemented with semi-structured interviews with actors of the tourism industry in the binational Colombian–Ecuadorian zone. Direct observation in the field was used to describe the aspects that characterize and describe a waterfall. All the information gathered was analyzed using a technique known as expert judgment, which made it possible to establish the aspects characterizing a waterfall.

With regard to the bibliographic review to learn about the historical importance of waterfalls in nature tourism, a search of scientific literature was carried out in the high-impact databases Scopus and Web of Science. In addition, a search was conducted in regional databases such as Redalyc and Scielo. In order to filter the result of documents, an advanced search was used, which consisted of applying combinations of the words "Tourism" and "Cascades" with repetitions in English and Spanish, obtaining a total of 17 articles. Next, a reading of the title and summary of the documents was carried out in

order to unload the documents that were not related to the object of study of the research, so that nine documents were finally considered for the analysis (Table 1).

Table 1. Documents selected for bibliographic analysis.

Title	Year	Reference
Push and pull motivation factors: a panacea for tourism development challenges in Oluminrin waterfalls, Nigeria	2022	[8]
Sustainable Management: Tourism diversification to improve the offer in the Seven Waterfalls, Naranjal canton	2021	[31]
The travel cost approach for the demand natural tourism object of Cipendok Waterfall	2019	[32]
Planning a tourism landscape in geosite area: Sipiso–piso waterfall	2018	[33]
Tourism track management of Cibeureum Waterfall as a provider of landscape beautification service at Gunung Gede Pangrango National Park	2015	[34]
Semantic evaluation of waterfalls as tourism destinations	2016	[35]
Environmental perception in tourism of ecological park waterfall of Urubu in municipalities Esperantina and Batalha in the State of Piauí	2012	[36]
Waterfalls, tourism and landscape	2006	[37]
Waterfalls: resources for tourism	1998	[38]

3. Result

Considering the objectives established in this study, initially a historical compilation of the importance of waterfalls in nature tourism is presented. A second section describes the aspects that characterize and describe a waterfall from a landscape approach.

3.1 Importance of waterfalls in tourism

Initially, the romantic movement developed during the 19th century encouraged interest in the landscape and waterfalls, recognizing their commercial potential, which led to the development of new infrastructure and services to increase access and interest in this resource [9,38]. For many years, waterfalls have been considered tourist attractions that attract the attention of tourists due to various factors such as their scenic beauty, enjoyment of recreational activities, natural pools, melodious sounds of falling water, recreational opportunities, popularity, and sacred character. At the present time very, few waterfalls have become consolidated as a tourist destination, but there are an infinity of waterfalls in a state of resource that are very attractive at the time of their visit [8,33].

In the last three decades one of the most demanded destinations by tourists within the segment of nature tourism has been waterfalls. This element in the natural environment is characterized by waterfalls that occur when there is a difference in level or geological fault and by the action of gravity the masses of water that flow smoothly fall directly to the ground nearby [32,37]. Their importance in ecosystems lies in the balance

they provide, being a source of oxygenation in water bodies and contributing as a natural barrier for biodiversity sources and species refuge [9,32]. In addition to their ecological function, it is important to highlight their value as a resource in the scenic beauty of a landscape and their contribution to nature tourism. In addition, in the post-pandemic period, it has become vitally important as destinations that are enjoyed in the open air and significantly reduce contact with or staying close to other tourists, in line with worldwide recommendations to reduce COVID-19 infection.

Tourists interviewed at the customs crossing point stated that the main motivation for visiting the Colombian-Ecuadorian Amazon region is its natural wealth and biodiversity. 100% of tourists coming from Colombia to Ecuador said they had visited the "Fin del Mundo" waterfall in the department of Putumayo, and what most captivated them was the trail, the various waterfalls and geological formations along the river in the form of natural pools. While tourists crossing the border from Ecuador to Colombia, 75% said that in Sucumbíos they visited the Wildlife Cuyabeno Reserve as their main motivation and only 25% were initially motivated by the waterfalls; but of these 75%, 50% heard about the waterfalls route and decided to visit them without having planned to do so, indicating that they would visit this route again and the waterfall that most attracted them was "La Libertad", in the Gonzalo Pizarro canton, Sucumbíos. With respect to security, they consider that there is good control by the authorities and the security forces. None of the interviewees stated that they had had a bad experience in Ecuador or Colombia, but they did indicate that before starting the trip, their greatest fear was crossing the Putumayo area, due to the various reports of drug trafficking and kidnappings.

In interviews with nature tour guides on the binational Amazonian border between Colombia and Ecuador, 87% of the tourists who arrive in this area attracted by nature tourism are inclined to visit waterfalls. It is important to note that this preference is selected among a set of activities such as visiting lagoons, local parks and indigenous communities. Since 1990, one of the most visited reserves in the binational zone has been the Cuyabeno Wildlife Production Reserve, known worldwide for its pink dolphin (*Inia geoffrensis*) sightings. Initially, tourists used the cities in this region as a transit zone and went directly to the nature reserve due to security concerns and distrust in an area tarnished by drug trafficking and its associated problems. But this has changed in the last decade in both the Province of Sucumbíos in Ecuador and the Department of Putumayo in Colombia, and the waterfalls have played an important role in making foreign and national tourists decide to extend their stay and visit destinations other than those traditionally known. So much has been the rise of nature tourism activities in the area, that the border crossing of San Miguel, which historically was unthinkable to serve as a tourist corridor, is now very easy to observe the passage of tourists daily between these two countries.

The natural beauty of the waterfalls in the binational Amazonian zone has attracted the interest of several television producers for reports and social events in general. In the province of Sucumbíos, one of the cantons characterized by the largest number of waterfalls is Gonzalo Pizarro, where waterfalls such as La Libertad (Figure 1a),

Escondida, Chocolatera, Cabeza de Lagarto, among others, stand out. Likewise, in the department of Putumayo, the waterfalls of El Fin del Mundo (Figure 1b), Del Indio, Chigayaco, among others, are tourist resources that have been transformed and have acquired a high tourist value, transforming this area, which four decades ago was known for drug trafficking and violence, into one of the fastest growing areas in the Colombian Amazon in terms of nature tourism.



Figure 3. Natural tourism resources in the Colombian–Ecuadorian Amazon. (a) La Libertad waterfall, Sucumbíos, Ecuador. (b) Waterfall at the end of the world, Putumayo, Colombia.

3.2 Aspects which characterize and describe a waterfall from a landscape approach

Before describing the landscape, aspects which characterize a waterfall, it is important to put into context the importance of the landscape. This element is one of the valuable assets of tourism, especially rural tourism. The appreciation of a landscape can be developed by observing a mountain, valley, cliff, volcano, waterfall, river, among others. Good landscape planning can increase tourism in a place. Landscape consists of three fundamental elements, namely, landscape structure, landscape function and landscape change [32,33]. However, when planning the landscape, planners must understand the dynamic interaction between landscape structure and landscape function. Landscape structure is the spatial relationship between landscape elements. Landscape function, on the other hand, is the interaction between animals, people, water and plants that occurs in landscape elements [32,34].

Generally, waterfalls are formed as the constant action of water on different types of rock erodes those of lesser hardness. After years of erosion, the river channel is cut so

deeply into the bed that only harder rock, such as granite, for example, remains. Waterfalls develop as these granite formations form cliffs down which the watercourse falls. Other times, however, waterfalls form due to an earthquake, landslide, glacier, or volcano eruption that alters river channels [35].

Water and sediment fall down the waterfall, steadily eroding the base of the waterfall. The resulting erosion at the base (the lower area) of a waterfall can cause the waterfall to "recede". The area behind the waterfall is worn away, creating a hollow, cave-like structure called a "rock shelter." Eventually, the edge of the waterfall (also called a rock ledge or outcrop) may fall away, sending rocks into the stream bed and submerging the pool below. This causes the waterfall to "fall back" many meters upstream. Thus, the process of waterfall erosion begins again, breaking up the rocks of the old outcrop. In this way the waterfalls take on unique geomorphological characteristics that with the environmental conditions each of the ecosystems will be unique in their composition [35,38].

Most of the waterfalls are permanent. Landmarks of the rivers engraved in the rock, but in places where rainfall is abundant, as in tropical forests or in northern Patagonia, waterfalls can be ephemeral events that fall from the tops of the hills [33,37]. These ecosystems are so saturated with water that the soil is not capable of capturing it during frequent storms, in addition to the fact that they are composed of granitic rocks with low or no water retention capacity, which causes water to run off the surface, forming temporary waterfalls, which can last a few hours [33]. The erosive impact of these is much less than that of their permanent counterparts, but they form a spectacle worthy of admiration.

Waterfalls are habitats that present unique ecosystem conditions. One of them is the "rock shelter" mentioned above and located behind the waterfall, which is protected from the environment by the water torrent. This refuge is usually inhabited by various species that find safety in these places of difficult access for their predators. One example is the waterfall swift (*Cypseloides senex*) in Iguazú. These brave birds' nest under one of the most powerful waterfalls in the world. Under their shelter the only danger is the waterfall itself, as predators have no way of accessing their nests.

Multi-level waterfalls, also known as tiered or step waterfalls, are formed when water flows down a series of cascades or steps. Unlike single-fall waterfalls, multi-level waterfalls create a multi-layered spectacle that enchants and captivates viewers. The distinctive characteristics of these waterfalls make them stand out in terms of visual appeal and provide various benefits to both the environment and visitors. Let's delve into some of the remarkable features and advantages of these natural wonders.

The multi-tiered structure of these waterfalls creates an incredible visual display. As the water descends from one level to the next, it forms intricate patterns and weaves a captivating dance in harmony with nature. This breathtaking spectacle has made multi-level waterfalls popular with nature enthusiasts, photographers and artists, who seek to capture their beauty in various forms [37,38].

Multi-level waterfalls have deep cultural significance in many regions of the world. They are often revered as sacred sites and play a vital role in folklore and traditional

beliefs. These majestic waterfalls have served as pilgrimage destinations, sources of inspiration for art and poetry, and symbols of power and spirituality in various cultures throughout history.

Waterfalls are not only a natural wonder that captivates the eyes, but also play a crucial role in the sustainability of the planet. Their presence contributes to maintaining the ecological balance of aquatic and terrestrial ecosystems [33,34]. In addition, waterfalls act as natural filters that purify water and promote biodiversity by providing habitats for diverse species. It is essential to protect and conserve these natural beauties in order to preserve environmental sustainability [32,35].

Regarding our topic of study, the landscape of a waterfall can be evaluated taking into account two general considerations: the physical characteristics such as height, water color, characteristics of the beach or bathing area, among others; and the anthropic pressures such as the presence of waste, noise, agricultural activities, among others. This information has been evidenced in the literature review. However, it is necessary to fully understand the true perception regarding the preference of tourists who have previously visited a waterfall tourist destination.

4. Conclusions

The results indicate that physical and anthropic aspects serve to characterize a waterfall. Likewise, it is essential to focus efforts to consult tourists who have already visited waterfalls so that they can describe and indicate their preferences through interviews that could be done through contact information at control and access points, such as e-mails. In general, multi-level waterfalls show the sheer power and beauty of nature. Their presence not only leaves us in awe, but also reminds us of the importance of preserving these natural wonders for future generations to appreciate.

The spaces destined for nature tourism are the result of areas in which biological, physical and cultural characteristics converge and which have a greater or lesser socio-environmental sensitivity, according to the stage of tourism in which the product is found, its implications and its social, economic and environmental conditions. The greater the socio-environmental sensitivity, the greater the complexity of product management and/or investment costs.

An impressive landscape is often not enough to make a destination interesting for nature tourists. Tourism offerings are also necessary to attract travelers. This includes a good variety of activities, e.g. well-developed and signposted hiking trails. A gastronomic offer in the vicinity can also be an advantage and make the destination more attractive to tourists. Interesting learning opportunities, such as a nature trail with information and the information centers mentioned above, can also add value to a destination.

Exploring the power and magnificence of multilevel waterfalls leaves us with some key conclusions. Multi-level waterfalls offer a breathtaking visual spectacle with their unique cascading structure.

These waterfalls are home to a wide range of plant and animal species, which contributes to biodiversity conservation. The amplified hydropower of the multi-tiered

waterfalls presents opportunities to harness renewable energy. They have important cultural and historical value in many societies and capture the imagination of people over the centuries.

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