"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

Original Article

GEOTOURISM POTENTIAL AND CHALLENGES OF WAULPANE LIMESTONE CAVE

M.A.T. Thilakshana[1*]

[1] Department of Geography, University of Ruhuna

***Corresponding Author:**
M.A.T. Thilakshana
thimirauniversity@gmail.com

Abstract

The primary objective of this article is to assess the geotourism potential of the Waulpane Limestone Cave and to identify the various challenges hindering its sustainable development. As a sub-sector of sustainable tourism, geotourism focuses on utilizing unique geological and natural landscapes for educational and conservation purposes. Despite its significant geological and biological importance, featuring a magnificent internal waterfall, rare bat species, diverse fossils, and vital limestone geomorphological formations, the Waulpane Limestone Cave has not been properly developed or managed within a sustainable framework. This article addresses a critical research gap by conducting a site-specific analysis. A qualitative methodology, primarily involving key informal interviews and field observations, was employed to analyze the cave's unique characteristics, existing tourism practices, and their impact on the social space. Furthermore, the A, B, C (Abiotic, Biotic, and Cultural) framework was utilized to provide a comprehensive understanding of the site. The findings reveal that while the cave possesses immense geotourism potential, its sustainability is currently threatened by informal tourism activities and inadequate management. This study proposes practical recommendations, including pursuing UNESCO Global Geopark status and enhancing community participation, to guide the development of a well-managed and ecologically responsible tourism experience.

Keywords: Geotourism, Geo-heritage, Limestone cave

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

1. INTRODUCTION

Tourism is the process of traveling to a place outside one's usual place of residence and returning within a period of not more than one year, without the intention of earning a living (Dowling & Newsome, 2006). In an age of heightened ecological consciousness, the tourism industry is evolving from traditional, large-scale models toward more specialized and sustainable forms of travel. One such form is geotourism, which is rooted in the appreciation and responsible engagement with Earth's geological heritage. It goes beyond mere sightseeing by focusing on the unique geological features of a location, such as landscapes, formations, and landforms (Cooray, 1994). The purpose is to provide an educational and immersive experience that fosters understanding of geoscience while promoting the conservation of these natural assets. By linking a place's geology with its culture, environment, and history, geotourism adds a new dimension to travel. Globally, initiatives like the United Nations Educational, Scientific, and Cultural Organization (UNESCO)'s "Geoparks" have demonstrated how geotourism can become a powerful tool for driving economic growth and sustainable development in local communities. This form of tourism represents a deliberate, purposeful shift toward a deeper connection between visitors and the planet's legacy.

Despite the global momentum surrounding geotourism, Sri Lanka's efforts in this area have been remarkably limited. Although the nation is known for its rich cultural history, diverse wildlife, and breathtaking coastal scenery, its significant geological diversity has been largely underutilized in the national tourism strategy. The country's diverse geology, which includes ancient cave systems, mountainous terrain, and unique rock formations, offers an excellent opportunity to diversify the tourism market (Sinopoli, 1994). This can attract specific groups such as researchers, geology enthusiasts, and eco-friendly tourists. In this context, the Waulpane Limestone Cave, located in the Kumburugamuwa Grama Niladari Division (GND), Buluthota Divisional Secretariat Division, Rathnapura District, emerges as a site of particular importance. It is considered the largest and most important limestone cave in Sri Lanka, with immense geological, archaeological, ecological, and cultural value. Formed by water over approximately 500 million years, it features a unique micro-karst landform, an underground river and waterfall, and a unique ecosystem (Thamodi and Kumara, 2020). The cave is home to rare bat species and contains ancient fossils, all of which contribute to its high potential for scientific, educational, and geotourism.

The Waulpane Limestone Cave System faces many obstacles that hinder its sustainable development. A major problem is the lack of official recognition and a formal management plan. The cave is not officially designated as a 'geosite' or geopark, which prevents it from being a priority in national tourism and conservation policies. The lack of a structured management framework, combined with the lack of basic visitor facilities, further hinders its ability to meet both tourism and conservation goals (Ranasinghe & Cheng, 2020). The cave's unique geological and biological features are also at risk from unregulated human activities, informal tourism, and the impacts of climate change. Furthermore, the site suffers from poor public awareness, limited promotional efforts, and a lack of geo-education programs, which limits the number of visitors to the cave. Local communities, who are integral to the cave's identity, have minimal participation in its planning and management, which undermines its long-term sustainability. The lack of a

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

specific legal framework for geotourism and the failure of government agencies to properly protect the site are major factors contributing to the increase in these problems.

This study mainly aims to fill a significant gap in existing research, as most previous work has focused on broader regional assessments or more accessible locations in Sri Lanka rather than a direct, in-depth analysis of the Waulpane Limestone Cave. Although the cave has been mentioned in some academic texts, no comprehensive study has assessed its readiness for geotourism, including visitor management, interpretive facilities, or conservation strategies. Furthermore, while the A, B, C framework (abiotic, biotic, and cultural) is a widely accepted model of geotourism, its specific application to the Waulpane Limestone Cave has not been investigated at all. This research aims to provide a multifaceted, site-specific analysis that integrates geology, environmental management, tourism, and community development. I believe that the findings here will contribute to both academic knowledge and practical strategies for geotourism development in Sri Lanka.

The primary objective of this Article is to create a sound plan for the sustainable management of the Waulpane Limestone Cave, improve the visitor experience, support local communities, and develop the site as an example for future geotourism initiatives in Sri Lanka.

2. BACKGROUND OF GEOTOURISM

The field of geotourism has evolved over the past few decades as a multidisciplinary concept rooted in geology, ecology, geography, and cultural studies. Hose (1995) defined it as a form of tourism that provides interpretive services and facilities to tourists to understand the geological and geomorphological significance of a site. Later, the definition evolved to include educational, environmental, and socio-cultural dimensions. Dowling and Newsome (2006) emphasized that the field of geotourism promotes the conservation of geodiversity and the appreciation of earth sciences through sustainable tourism practices. One of the most widely accepted frameworks in the field of geotourism is the A, B, C (Abiotic, Biotic, and Cultural) concept, which classifies geotourism elements into abiotic (geology and landforms), biotic (biodiversity), and cultural (human traditions and history) components (Dowling, 2013). This model allows for a holistic assessment of a site's geotourism value, particularly when assessing landscapes such as limestone caves where geology, ecology, and human interaction converge.

Globally, UNESCO Global Geoparks serve as benchmarks for the development of geotourism. These areas integrate conservation with education and community development, turning geological heritage into tools for regional development (UNESCO, 2011). Successful geoparks in Europe, Asia, and South America have already demonstrated how geotourism can support local economies, create jobs, and promote geo education while maintaining the integrity of natural resources.

However, geotourism in Sri Lanka is still underdeveloped, lacking any institutional or government intervention despite the country's vast geological diversity. According to Katupotha and Sumanaratne (2020), Sri Lanka has significant untapped potential due to its ancient Precambrian rock formations, diverse ecosystems, and geologically significant cultural heritage sites. However, national tourism planning still primarily prioritizes coastal tourism and wildlife over geological attractions. For example, the Waulpane

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

Limestone Cave has been identified as a site of significant special scientific and ecological identity in limited studies. Their study described various microkarst landforms, stalactites, stalagmites, and internal hydrological systems within the cave (Thamodi and Kumara, 2020). However, this research focused largely on the study of geomorphological features rather than tourism development or sustainable management.

The major challenges facing geotourism development in Sri Lanka to date have also been well documented. Subasinghe et al. (2021) highlight issues such as inadequate infrastructure, lack of community participation and education, weak promotional strategies, and insufficient training among local tourism stakeholders. In addition, existing tourism expectations and financial constraints further hinder the effective implementation of geotourism principles.

Government involvement in geotourism is still minimal. Although Sri Lanka has several relevant legislative policies, such as the Tourism Act No. 38 of 2005 and the Sustainable Development Act No. 19 of 2017, there is no legal or policy framework specifically dedicated to geotourism (Perera and Wasantha, 2024). This policy gap leads to poor protection and promotion of valuable geotourism potential, such as the Waulpane. Regarding community participation, Edwards (2007) and Jamal and Stronza (2009) reveal that the success of geotourism depends on the active participation of local communities. They are the custodians of natural and cultural heritage, but their roles are essential in promoting stewardship, interpreting geological features for visitors, and ensuring that tourism activities benefit the region socially and economically.

Furthermore, research that directly applies the A, B, C (Abiotic, Biotic, and Cultural) framework to specific sites in Sri Lanka is minimal. In addition, although the concept is widely referenced, few studies explore how geological features (abiotic), associated ecosystems (biotic), and local traditions or histories (cultural) can be integrated into tourism planning (Dowling and Newsome, cited in Pathmasiri & Fernando, 2024 & 2025). This creates a significant gap in both academic understanding and practical application, especially as it affects sites with potential geotourism significance such as the Waulpane Limestone Cave.

In conclusion, while the international literature provides a solid foundation for understanding geotourism, there is very limited local research in Sri Lanka in this area, which is far from sufficient. There is a dire need for comprehensive, site-specific studies that evaluate geotourism potential using multiple frameworks. This research primarily aims to fill that gap by focusing on the Waulpane Limestone Cave and presenting a detailed analysis of its A, B, and C characteristics, stakeholder dynamics, and development challenges.

3. METHODOLOGY AND METHODS

3.1. Research Design and Approach

This study aims to understand the geotourism potential of the Waulpane limestone cave and the challenges that arise in it, and to find solutions for it. Qualitative research methodology was chosen for its ability to capture the rich, contextually specific information that is essential for this. A qualitative approach allows the researcher to clearly explore the geological, environmental, and cultural dimensions of the research area, rather than relying solely on quantitative data, through observation, documentation, and stakeholder participation. This approach is particularly suitable for interdisciplinary

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

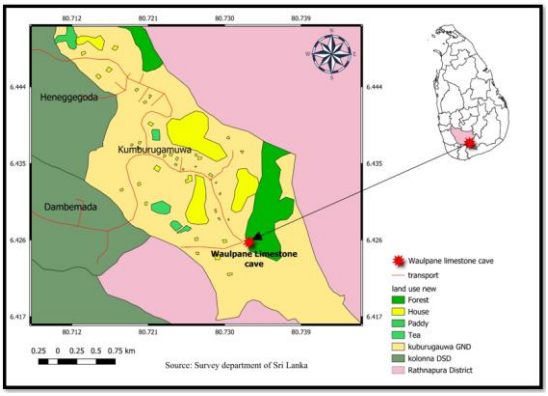
studies involving natural, cultural, and human aspects of the tourism sector. This research integrates the basic principles of geography, geology, environmental management, and tourism studies, and comprehensively analyzes the geo-tourism value of the field in accordance with the A, B, C framework (abiotic, biotic, cultural).

3.2. Study Area

The Waulpane Limestone Cave is located in the Kumburugamuwa Grama Niladhari Division of the Kolonna Divisional Secretariat Division, Ratnapura District, Sabaragamuwa Province, Sri Lanka. Located at an elevation of 278 meters above sea level and about 14 kilometers from Pallebedda, this cave is located on the eastern slopes of the Buluthota Rakwana mountain range (Thamodi and Kumara, 2020). It is located at coordinates 6º25.5'N, 80º43.8'E. There are two main entrances to the Waulpane limestone cave. that is, the main entrance & the back entrance. The main entrance is the primary entrance. Along the same path, the water stream also enters the cave. The path of the cave is created along the water stream. The Back path is mostly the destination. This is where the path of the cave ends, and you can exit through that portal or the same way you came back (Thamodi and Kumara, 2020).

The name "Waulpane" means "Cave of Bats". The Waulpane limestone cave is home to approximately 800,000 bats and contains unique microkarst features, ancient fossils, an underground river system, and a rare internal waterfall. Estimated to be over 500 million years old, the cave is a valuable resource for geological, biological, and archaeological research (Thamodi and Kumara, 2020). Despite such importance, it is largely undeveloped and faces a number of conservation and tourism management challenges and issues.

Figure 01: Location of Waulpane limestone Cave and Kumburugamuwa GND



3.3 Justification for Using Qualitative Methods

The primary objective of this research is to explore the geotourism potential of the Waulpane limestone cave and identify the challenges it faces. The use of a qualitative approach is justified by:

- The geotourism value of the limestone cave includes interpreting natural features, ecosystem dynamics, and cultural narratives, which can be better understood through qualitative approaches and tools such as interviews and field observations.
- This methodology well supports the multidisciplinary nature of the research and enables the integration of geological insights with social and cultural perspectives.
- It allows for a contextual exploration of stakeholder perspectives, community attitudes, and site-specific methodologies that cannot be easily quantified and calculated.

3.4 Data Collection Methods

A multi-source method was used to collect data.

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

Primary Data Collection

- Field Observations

  A site visit was conducted to assess geological features, biodiversity, visitor access, and existing infrastructure. I went to the field to collect data on October 1, 2025.
  Detailed notes and photographs were taken of features such as stalactites, stalagmites, cave passages, fossils, Environment, flora & fauna, and speleothems.
  Observations included signs of degradation such as damage, debris, or erosion.
- Key informant interviews

  The main reason for using purposive sampling is that when conducting research on a place of specific geographical and cultural importance, such as the Waulpane limestone Cave, it is necessary to select people with a special understanding and knowledge about that subject area. This allows us to ensure the quality and accuracy of the information. Here, I focused on three main components. These are,

  - Presence of specialized knowledge: People who have more understanding of the cave than the average person (guides, officials) can obtain accurate technical and historical data.

  - Taking into account perspectives: Since the sample has been prepared to cover various fields related to the Limestone Cave, such as business, transportation, educational, and cultural sectors, it is possible to cover a wide range of data for the article.

  - Practicality: If a random sampling method were used, even those who did not know the limestone cave could be selected. However, this method ensures that only relevant individuals are contacted.

Table 01: This includes information on how data was collected through focus group

Group	Number of people	Reason
Guides	06	The nature, safety, history & tourist importance of the cave.
Teachers	04	Understanding the educational value of the cave.
Farmers	04	Land use, environmental impact & cultivation activities around the cave.
Taxi drivers	03	Tourist arrivals & access facilities.
Women	03	Impact on the Waulpana related community.
Shop owners	02	Economic development of the area through tourism.
GN officer	01	Local governance & infrastructure.
Chief Prelate of the temple	01	The religious & cultural significance of the area.
Officers of the Ministry of Tourism	03	Geotourism importance, trends & regulations of the cave.
Tourist	02	The importance of limestone cave, the feeling of the place & the facilities.
Total	29	

The table above shows the sample size I used. Here, I used a sample of 29 people. When collecting data through a qualitative research method, when the sample size is between 25-30, all the necessary basic information is covered. Then the data iteration begins. Here, I have selected 10 categories, which represent all the layers relevant to the article. Also, selecting a sample of 29 people allows for more reliable conclusions to be drawn through in-depth interviews than selecting a larger number.

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

Secondary Data Collection

- Academic journals, government reports, policy documents, and geological surveys were used to substantiate field findings.
- The main sources used included works by Dowling and Newsome (2011, 2006, 2010), Katupotha and Sumanaratne (2020), Thamodi and Kumara (2020), Pathmasiri & Fernando (2022, 2023, 2024, 2025), and the Sri Lanka Tourism Development Authority
- Laws, regulations, and policies related to tourism and environmental management (for example: Tourism Act No. 38 of 2005, Sustainable Development Act No. 19 of 2017) were analyzed.

3.5. Data analysis techniques and data presentation

3.5.1 Data Analysis Techniques

The data analysis technique used here is the qualitative approach. Here, the specific techniques and frameworks used for data analysis can be presented in a systematic manner as follows.

A, B, C framework

The main model used to analyze the data in this paper is this. The collected data is presented under three main sections. namely,

- A (Abiotic): Geological features and landforms of the Waulpane limestone cave (limestone formation, geology, stalactites, stalagmites).
- B (Biodiversity): Biodiversity of the ecosystem in and around the cave (bat species, flora, fauna).
- C (Cultural): Folklore and community relations through human interactions.

Thematic analysis

Based on the objectives of the research, the information obtained through field observations and interviews has been described under several main themes: geotourism potential, infrastructure and management issues, and socio-spatial impact.

- Data collection and verification methods

  To ensure the accuracy of the research, data have been obtained from several sources. namely,
  - Field observations: Analysis of the physical structure of the cave and the areas where it has begun to be destroyed, plant diversity, animal diversity, photographs, and notes.
  - Interviews: Obtaining information from twenty-seven people selected through purposive sampling.
  - Secondary data analysis: Comparison of primary data with academic reports, government policies, existing research reports, and geological survey data.

3.5.2 Data Presentation Methodology

Here, a qualitative descriptive technique was used to present data and information. The main ways in which data is presented are,

- Classification through the A, B, C Framework: In this way, the complex data has been divided into three main parts to present the information of the article. This enables the reader to easily understand the subject matter.
- Thematic Presentation: Here, all the data collected by me has been arranged under several main themes.
- Systematic Structure: The article has used very systematic steps from beginning to end.
  - Abstract: Here, a rough summary of the entire research is given to the reader to understand.
  - The introduction identifies the problem.

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

- The data and information found through the analysis are presented logically.
- The proposals are presented based on the data analysis.

In summary, this article is presented under a systematic information presentation technique that combines tables, maps, and detailed reporting based on the A, B, C framework.

4. RESULTS

The findings of the research revealed that the Waulpane limestone cave and its geological uniqueness and significance, surrounding ecological value, and cultural elements have significant geotourism potential. However, this potential remains largely untapped due to a number of interconnected environmental, infrastructure, and management challenges. The results are presented in the following manner according to the research objectives and the A, B, C (abiotic, biotic, cultural) framework. Although the geological significance of the Waulpane limestone cave has been primarily demonstrated, it cannot be framed solely within the field of geological tourism. The main reasons for this are the combination of three main components of the area: geological, biological, and cultural. That is, even human activities have been mixed with this limestone cave. Therefore, as I think, the geological tourism field covers all these parts, where the geotourism field is mainly divided into geological and geotourism fields. This allows us to define this research field mainly as a geotourism field. The main reason for this is that all the parts (abiotic, biotic, and cultural) have come together and operated here.

4.1 Abiotic Features: Geological and Physical Uniqueness

Field observations and geological literature confirm that the Waulpane limestone Cave is one of the oldest cave systems in Sri Lanka, having been formed approximately 500 million years ago (Thamodi and Kumara, 2020). The following abiotic features have been identified;

Figure: 02. Micro karst landforms & front of cave

Source: collected by the author (2025)

The image (Figure 02) on the left shows the rear opening of the limestone cave. The center image reflects the distribution of limestone across the ceiling at the back of the cave. The image on the right identifies the front entrance used to access the limestone cave.

- **Stalactites and Stalagmites:** Visually prominent limestone formations (stalactites, stalagmites) throughout the cave, clearly demonstrating the long-term deposition of calcium carbonate.
- **Speleothems and Draperies:** Several micro-karst formations of rare geological beauty and significant research value have been formed here. These have been created over time by water carving into calcium carbonate through limestone over a period of about 500 million years.
- **Underground Stream and Waterfall (Halwini Dola):** The Waulpana waterfall is formed by the Katukumbura stream, which emerges from the earth's surface at a height of approximately 50m and 100m from the cave entrance, entering the cave

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

chamber through the Halwini dola (Figure 03 left) (Thamodi and Kumara, 2020). The other stream originates from the Kiul Diya ulapatha (Brackish water stream), where it starts, and flows to a water reservoir with a muddy color. There is a high concentration of salts here. This is due to the compounds such as calcium carbonate, iron hydroxide, and magnesium sulfate contained in the water (Figure 03 Right). This stream creates underground waterfall (Waulpane Ella) (Thamodi and Kumara, 2020). The presence of an internal hydrological system, including a flowing stream and an underground waterfall, represents a highly valuable aesthetic value and further geological significance, which is a special reason for the uniqueness of the limestone cave site.

Figure 03: Halwini dola stream path for cave & Kiul Diya Ulapatha (Brackish water stream)

Source: collected by the author (2025)

The image (Figure 03) on the left presents the area entering through the front entrance of the Halwini Dola limestone cave. The image on the right displays the brackish water spring (Kiul Diya Ulpatha) located in the upper zone of the Waulpane limestone cave, which feeds the Waulpane Waterfall. This water enters the cave through a collapsed section of the ceiling, creating the internal Waulpane Waterfall, which stands approximately 45 meters high.

- **Fossil evidence:** Fossilized parts of Coral, Seaweeds, Sponges, and small marine organisms have also been identified on limestone fragments, & The fossil remains (shells and bones) embedded in the cave walls provide valuable evidence of the ancient geological and archaeological history of Sri Lanka (Sumanarathna, A.R. et al, 2016). They reveal a lot of valuable information about how Sri Lanka was formed, namely the central mountain range and the coastal plain. This reveals that in the past, this area was also submerged in the ocean, and later the central mountain range was gradually formed due to geological processes.

These abiotic features make the cave a valuable landmark for geo education, scientific research, and geological interpretation, and fulfill many of the key geotourism criteria.

4.2 Biotic Features: Biodiversity and Ecological Value

The Waulpane limestone Cave is a habitat for a large number of endemic and sensitive plant and animal species, the most notable of which are:

- **Bats:** It is currently estimated that about 800000-1000000 bats, including several species of bats that are essential to the cave ecosystem, have made it their home (Thamodi and Kumara, 2020). The main bat species living here are the *Hipposideros fulvus, Hipposideros lankadiva, Hipposideros speoris, Rousettus leschenaultia, Rhinolophus rouxii & Miniopterus schreibersii.* These bat species are the main bat species living in the Waulpane Limestone Cave (Department of Forest Conservation, 2020). Of these bat species, 5 are Herbivorous, and one is Carnivorous.

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

- **Insect Species:** The interior of the cave is home to a large number of small insects, cockroaches, and spiders that feed mainly on bat droppings (Figure 04). In addition, several species of ticks live on the skin of bats. Furthermore, as for reptiles, several species of snakes feed on small animals and bats in the cave, as well as several stone-crushing reptiles, Bengal monitor (*Varanus bengalensis*), Water Monitor (*Varanus salvator*), Leschenault's Snake-eye (*Ophisops leschenaultii*), and scorpions can also be seen. Furthermore, there are small fish in the dam, where there is a water environment, where valuable fish species such as Thalkossa (*Belontia signata)* and Bulath hapaya (*Pethia nigrofasciata)* live, and there are also frog species like *Euphlyctis hexadactylus, Euphlyctis mudigere, and Minervarya agricola***.**

Figure: 04: Insect species that live inside the cave (Cockroaches, Spiders)

Source: collected by the author (2025)

Figure 04 illustrates the distribution of insects and various small animals living inside the limestone cave. As shown in the photograph, a large number of species, including cockroaches, spiders, and geckos, were identified here.

According to a study conducted in 2001, 13 species of Butterflies, 4 species of Freshwater fish, 2 species of Amphibians, 9 species of reptiles, 56 species of birds, and 10 species of mammals have been recorded from the environment surrounding the Waulpane limestone cave (Department of Forest Conservation, 2020).

- **Birds**: As for birds, various species of birds can be seen near the surface environment of the cave. Among those species are the Sri Lankan red-faced Malkoha (*Phaenicophaeus pyrrhocephalus*), a bird with a bright red face that is unique in the humid environment. But this bird species includes this area. The Lanka yellow-eared bulbul (*Pycnonotus penicillatus*) is a special type of bird here.
- **Plants around the Cave:** The forest area around the limestone cave is a major support for local biodiversity and serves as a natural protected area. There are a number of plant species with a large forest cover adapted to the Intermediate climate zone (Figure 05).

Figure 05: The forest system and plants adapted to the intermediate climate within the reserve

Source: collected by the author (2025)

Among them are rare and valuable plant species such as trees like *Limonia acidissima, Berrya cordifolia, Trema*

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

orientale, Vitex altissima, Calamus thwaitesii, Croton aromaticus, Flueggea leucopyrus, Munronia pinnata, Asparagus racemosus, Toddalia asiatica, and Smilax zeylanica, which grow along the straight stems, are also included. In addition, the Mus Vines that grow especially high are examples of the special plants' distribution in this area.

The image on the left (Figure 05) identifies a distribution of flora adapted to the climatic conditions of the Waulpane area. This vegetation shows adaptations characteristic of the Intermediate Zone climate. The image on the right identifies a Hal-milla (*Berrya cordifolia*) tree that has grown straight upward.

The bio-ecosystem not only adds ecological importance but also increases the attraction of the cave to eco-tourists, researchers, and students for educational purposes.

4.3 Cultural Elements: Human Interaction and Local Value

Interviews with residents and local guides revealed a fairly deep cultural connection between the Waulpane community and the cave:

The name "Waulpane" itself means "Bat Cave", and the people living in the area call it the "*Bat Palace*". In the past, people used to cut the limestone here and use it to decorate and paint houses. Another legend is that it is a cave where treasures are kept and that there are ghosts to protect it. According to the villagers, the Waulpane limestone cave is a very valuable resource for the area. Unlike other places, Waulpane does not have various legends. There are very few. But it has a very close relationship with the villagers. This has created a risk to the cave and tourists who come to visit. In addition, there are two other valuable geotourism sites in the area surrounding the limestone cave. These are the Brackish water pond (Kiul diya peella) (Figure 07) and Yodhaya kapapu wala (Figure 06). There are legends that these places are held in special respect by the villagers. They can be described as follows:

"According to the villagers of the Waulpana village, the giant Pussadhewa yodha had a residence in the Sankapala area in the past. He came to the Waulpane area, selected a rock where water flowed, and created two main holes in the rock. According to the villagers, the large water-filled hole was used for bathing, and the smaller one above it was used for drinking. The villagers believe that there are treasures in that area. The specialty is that it is close to the limestone cave."

Figure 06: Yodhaya Kapapu Wala

Source: collected by the author (2025)

This image illustrates a water-filled pool-like feature, which is a river erosional landform characterized by potholes, created by the Halwini Dola in the upper region before entering the limestone cave. According to the villagers, the local name for this site is 'Yodhaya Kapapu Wala' (the hole dug by the giant).

The brackish water bath is a bath created by tapping a small underground brackish water spring that flows from above into a limestone

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

cave and using it for human cleansing purposes. The villagers believe that bathing or cleansing with this brackish water can cure skin diseases and other ailments and keep them healthy (Figure 07). They also provided a good example of this,

> "*An elderly man in the village has been bathing in this brackish spring since childhood and has not suffered any serious illness as a result.* "

Situated above the limestone cave, this structure, built across the brackish water spring (Kiul Diya Ulpatha) that creates the Waulpane Waterfall, is known as the 'Kiul Diya Peella' (Brackish Water Spout). The villagers use this for bathing purposes.

Figure 07: Kiul Diya Peella (brackish water)

Source: collected by the author (2025)

According to the villagers, community members, researchers, and students occasionally visit the cave, reporting that,

> *"One or two groups of people come to visit the cave every week, but we don't get anything out of it, at least there is no ticket office, the board that is put up is also damaged, there is no proper road for the least person who comes, no toilet, at least there is no bus to get to the village."*

This is a statement from one of the villagers living near the cave. This touches on a number of supply issues. If the limestone cave is sustainably developed, such problems would not arise. In addition, only minimal additional income is generated from the cave.

> *Nowadays, not many people come like before, son. If they do come, it's perhaps one person per week; even that is not a guaranteed arrival. Most of the visitors, if they come at all, use the Katukumbura side because that road is closer to Udawalawa for tourists visiting the cave.*

In addition, due to government intervention, there are no accommodation facilities for tourists visiting the Waulpane area. Furthermore, the toilet system that was designed for tourists in the past has now become dilapidated and unusable. Figure 08 reveals a toilet complex that was constructed by the government in the past for tourists visiting the Waulpane area, which has subsequently been abandoned.

The village of Waulpane is located in a basin-like area on the slopes of the mountains. The main livelihood of the people of the village is sorghum farming. Farmers clear the mountains surrounding the area and cultivate sorghum. The crops grown by the villagers are cinnamon, pepper, coffee, and tea. The left image of the Figure 09 identifies black pepper, a spice variety cultivated in the Waulpane area. The image on the right shows coffee beans being separated and dried in the sunlight.

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

Figure 08: Abandoned toilet system

Source: collected by the author (2025)

Figure 09: Black paper cultivation and coffee processing

Source: collected by the author (2025)

Paddy cultivation is also found in the plains. In addition, the wild rice variety *Oryza granulata*, which is an indicator of paddy cultivation, has spread in the areas around the limestone cave.

A fact revealed through the field survey conducted in the village is that there is a decrease in the youth population in the village. The main reason for this is that the youth have left the village to seek employment opportunities. This reveals another problem in the village, namely unemployment. Waulpana village consists of about 95 families. It is a very small population distribution.

The conclusion is that this cultural tourism potential is underdeveloped, but if tourism in this area is formalized and managed, the respondents were interested in activities such as accommodation, guided tours, and traditional food offerings.

4.4 Geotourism Potential and Site Appeal

Applying the A, B, C (abiotic, biotic & cultural) framework, this area was assessed as having moderate to high geo tourism potential, specifically:

- **Making it a Geotourism Destination:** The geotourism potential of the Waulpane area is very important. By properly managing that potential, Waulpane village has the potential to become a tourist destination. If all the necessary facilities are developed for that, a large number of foreign and local tourists will come. For this, it is the responsibility of the responsible institutions to increase the interest of the people of the area in the tourism sector (Pathmasiri & Fernando, 2022).
- **Educational Tourism:** This area is very suitable for educational activities by schools, universities, and educational institutions. This limestone cave, which has a Precambrian history of over 500 million years, is a very important place for developing educational knowledge,

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

exploring fossil species, and conducting research.

- **Adventure and Special Scientific Tourism**: Traveling in a limestone cave is an exciting experience. If that exciting experience is managed under a proper safety framework and an adventure tourism process is initiated, it is a place where people who are committed to various exciting experiences in the world can be reached. Furthermore, it has a Precambrian crystalline geological significance with a history of more than 500 million years and has great scientific value. It is a very important area scientifically due to factors such as limestone formation, fossil structures, formation method, and hydrological factors (Cooray, 1994).

However, the current lack of basic infrastructure, such as signage, lighting, safe access, proper guidance, and formal roads, limits the tourist experience and increases its risk. It is regrettable that a designated visitor center, ticket counter, restroom facilities, or emergency management systems, which are essential for the geotourism process, are not operational in this potential area (Pathmasiri & Fernando, 2023).

4.5 Identified Challenges

Stakeholder interviews and field observation identified several key issues in the Waulpane limestone Cave and the surrounding area:

- **Lack of Formal Management:** Although the Kolonna Pradeshiya Sabha is the institution that manages the Waulpane limestone Cave as a tourist hub, their tourism plan has not been properly developed, and there is a lack of transparency.
- **Environmental Degradation:** The accumulation of waste, graffiti, and trampling of the limestone landforms in the cave were observed, which indicates poor behavior of tourists and a lack of any regulation. In addition, water sources in the surrounding area are also under threat due to mining activities. If such damage continues, the Waulpane limestone cave will face a threatening situation. This requires full intervention by the responsible institutions.
- **Physical Impact:** The upper part of the Limestone cave is under threat of gradual Subsidence. According to villagers, this is due to the growth of plant roots, which have loosened soil and rock fragments and caused them to subside. Figure 10 identifies areas where sections of the limestone cave's ceiling have undergone localized collapses (subsidence).

Figure 10: How parts of the limestone cave have collapsed

Source: collected by the author (2025)

- **Limited Accessibility and Sanitation:** The access road to the Waulpane Limestone Cave and Waulpane village is in poor condition, with no signboards or public transport facilities. The existing bus runs only once a day. In addition, there are no sanitation facilities for tourists. It is a pity that such a valuable geotourism potential in the world is facing such a situation.
- **Awareness and Promotion:** There is only a minimal amount of information available

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

when looking for information about this tourism potential. There has been no initial promotion through websites. The website of the Ministry of Tourism also contains only a minimal amount of information. In addition, the number of research papers written about the Waulpane Limestone Cave is also very minimal. This generates only a minimal amount of information.

- **Community Exclusion:** Although the people of this area have some knowledge of the limestone cave, they are unable to identify any structured geotourism area or integrated conservation efforts.
- **Climate Change:** Climate change is gradually presenting the Waulpane limestone cave with several challenges. These include erratic rainfall patterns and long-term temperature changes. This is affecting the biodiversity of the cave and the limestone landforms. In particular, the fragmentation of limestone fragments, in addition to global warming, is also directly and indirectly affecting this highly sensitive geotourism potential.

4.6 Summary of Results

The Waulpane Limestone Caves exhibit high geotourism potential due to their geological features, ecological richness, and cultural characteristics. However, current conditions have limited that potential to become a sustainable geotourism destination. Key challenges include inadequate infrastructure, poor coordination among stakeholders, and the absence of a proper policy framework for the geotourism sector. Despite these limitations and challenges, there is a strong interest among the local community to collaborate and benefit from future geotourism development efforts.

5. DISCUSSION

The findings of this study reveal a complex interplay between the natural potential and management shortcomings of the Waulpane limestone cave, and identify issues and challenges in the geotourism sector in an underdeveloped, but ecologically important, site in Sri Lanka.

5.1 Unlocking the Geotourism Potential of Waulpane through the A, B, C framework

Using the A, B, C model as a guiding lens for abiotic, biotic, and cultural features, the Waulpane Limestone Cave exhibits high geo tourism value. This is a very important common factor for tourists of all sectors.

Abiotic factors: The cave's extensive limestone formations, limestone-related landforms, limestone-related internal hydrology, and Precambrian fossil evidence make significant contributions to geological tourism and geo education.

Biological factors: All animal and plant species that live in and around the Waulpane limestone cave are included. With a high population of bats and the associated ecosystem, this site offers significant potential for biodiversity studies and ecotourism.

Cultural: Although underdeveloped, the cultural community narratives and local relationships with the cave, if managed well, are an important factor for community-based tourism and interpretation.

These layers of natural and human heritage, as supported by Dowling and Newsome (2018) and the UNESCO Global Geopark criteria, enable the Waulpane Limestone Cave to be sustainably managed within a holistic geotourism framework.

5.2 A Missed Potential for National Geotourism Development

Sri Lanka's ecotourism, geotourism, and other

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

tourism sectors have largely focused on popular destinations such as Sri Pada, Sigiriya, Horton Plains, the South Coast, and Dambulla, and these potentials have been incorporated into the more accessible and already developed mainstream tourism sector. However, as Jayasinghe et al. (2023) have pointed out, this focus on key iconic sites has led to the neglect of less commercial but highly significant geo tourism potentials such as the Waulpane Limestone Cave.

The cave has,

- scientific significance (fossils, karst landforms),
- visual value (speleotums, internal waterfalls, adventure experience),
- ecological sensitivity (endemic flora and fauna),

The geotourism potential of Waulpane has not been formally incorporated into Sri Lanka's national tourism strategy and has not been identified for geotourism designation under any existing conservation framework. This highlights the wide national gap in geoheritage recognition and tourism diversification in Sri Lanka.

5.3 Community Readiness and Local Aspirations

One of the most valuable findings is the willingness and willingness of the local community to engage in tourism development. Residents expressed their willingness to provide accommodation, guide services, and even support conservation, but they have little understanding of current tourism or conservation efforts. It is a key responsibility of the government and the Ministry of Tourism to reduce these challenges and provide them with a better understanding and preparation.
According to Edwards (2007) and Jamal and Stronza (2009), the success of sustainable tourism depends on the empowerment of local communities. Their exclusion from relevant planning processes not only weakens conservation outcomes but also leads to their loss of livelihood opportunities.

For the Waulpane Limestone Cave, a community-based geo tourism model has the potential to deliver multiple benefits.

- Enable sustainable income for residents.
- Increase stewardship and conservation behavior, thereby enhancing safety and accountability.
- Enable tourists to gain a range of authentic experiences rooted in local knowledge.

5.4 Challenges and Factors that Undermine the Sustainable Development Process

Despite its geotourism potential, the Waulpane limestone cave system currently faces several challenges:

- Lack of infrastructure: Tourists face conditions such as unsafe roads, lack of proper signage, and lack of basic amenities (sanitation facilities), which compromise both safety and accessibility. example for the Katukumbura road & Buluthota to Waulpana village road. *(The road is not well built, son. When you come from the top to the village, there is a big gap. Two boys came on a bike in the dark and lost their brakes, and went down from there. They fell about 500 feet down. It happened recently.)* Villager says this.
- Lack of formal management: No responsible institution is active in preserving the cave, regulating visitors, or developing promotional efforts.
- Limited awareness and branding: This tourism potential is a largely unknown geo-tourism potential outside the local framework and does not appear to be

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

highlighted within the national or regional tourism system.

- Environmental degradation: Poor tourist behavior and poorly managed access pose a serious threat to the cave's fragile ecosystem, especially bat habitats and speleothem structures. Unnecessary cultivation practices.

These challenges reflect the issues highlighted by Subasinghe et al. (2021) in their analysis of geotourism challenges and barriers in Sri Lanka, which include issues such as outdated and fragmented policies, low institutional support, and poor coordination among stakeholders.

5.5 The Way Forward and Integrated Development Framework

There is a need for a multi-faceted, stakeholder and authority-led development model for the Waulpane Limestone Cave. This should include,

- Site designation and protection: The Waulpane Limestone Cave should be formally developed and managed and designated as a protected geotourism site, in addition to being a mandatory inclusion in the creation of a future Sri Lankan geopark network.
- Policy and Institutional Collaboration: Government institutions such as the Sri Lanka Tourism Development Authority (SLTDA), the Geological Survey and Mines Bureau, and the Ministry of Environment should be directly coordinated for this process.
- Promote community participation: Residents should be included in planning activities, benefit sharing, acquisition, and interpretation roles.
- Education and Promotion: Schools, universities, educational institutions, and media channels (television, social media, websites) can help raise awareness and promote responsible geo tourism.
- Investment in infrastructure: Basic infrastructure, sanitation facilities, signage, and security improvements should be given top priority.

5.6 Broader Implications

This study contributes to the practical knowledge and its application in providing a model and framework for applying geotourism frameworks to lesser-known sites and areas with tourism potential in the lowland southern region of Sri Lanka. It also demonstrates how natural heritage sites with small-scale mobile value can play a crucial role in sustainable development, biodiversity conservation, and community development, if they receive the necessary policy attention and resource investment.

6. CONCLUSION

The Waulpane Limestone Cave is a unique and underutilized geoheritage site in Sri Lanka, rich in outstanding geological formations, ecological diversity, and cultural significance. This study highlights that the cave has strong potential to become a leading geotourism destination that offers educational, recreational and conservation value, through the application of the A, B, C (abiotic, biotic, cultural) framework. However, current realities, including inadequate infrastructure, limited policy support, weak stakeholder coordination, and low public awareness of climate change, have severely limited this potential in recent years.

Importantly, local communities have shown a willingness to participate in and benefit from mainstream tourism development, making community-based geotourism a viable and sustainable way forward. This requires an

"*WISHWAYA*" Journal of Ruhuna Geography Review
Vol. 8, Issue. 1 (1-20)

ISSN: 2513-2768

integrated development strategy that aligns tourism practices and institutional collaboration, which includes geological conservation.

By formally recognizing the Waulpane Limestone Cave as a geosite of national importance, developing basic visitor infrastructure, and empowering local stakeholders, Sri Lanka will be able to position the site as a model for sustainable geotourism. In doing so, it will not only protect a significant natural heritage asset but will also contribute to rural development and educational advancement. Ultimately, the Waulpane Limestone Cave and its surrounding environment will provide an opportunity to balance conservation and tourism, while demonstrating the real-world value of geotourism in national development.

7. RECOMMENDATIONS

In order to unlock the geotourism potential of the Waulpane Limestone Cave to the world, while ensuring environmental and cultural sustainability, several key recommendations have been identified. Firstly, the cave should be formally recognized as a national geo site under a legal framework that ensures the long-term conservation of the Limestone Cave. Responsible government agencies such as the Sri Lanka Tourism Development Authority (SLTDA), the Geological Survey and Mines Bureau, and the Department of Wildlife Conservation should work closely together to create a site-specific management plan.

Secondly, it is essential to develop basic infrastructure. This includes safe access routes, visitor routes, signage, survival equipment and strategies, sanitation facilities, and safety equipment. Importantly, such development should be carried out in accordance with environmentally sustainable guidelines to minimize environmental disturbance.

Third, community-based tourism models should be introduced. Training programs for local residents in guiding, hospitality, and environmental education can encourage them to be key stakeholders and ensure fair sharing of benefits. Livelihoods can be improved by establishing cooperatives for housing, local crafts, and ecotourism. There is a will among the people of Waulpana village for this. Responsible government agencies should be the first to take the lead.

Education and promotion through academic partnerships, geotourism campaigns, and digital platforms can raise awareness of this geotourism resource nationally and internationally. Regular monitoring and evaluation of tourism impacts should be implemented to guide adaptive management. These efforts, collectively, can transform Waulpane into a model geotourism destination, balancing conservation, education, and sustainable rural development.

Increasing the tourism demand for the Waulpane Limestone Cave will increase the interest of tourists in it. For this, it is very important to limit the daily entry into the cave as necessary and have good management. Then tourists will start searching for the area.

REFERENCES

Chen, A., Lu, Y., & Ng, Y. C. Y. (2015). *The principles of geotourism*. Springer. https://books.google.com/books/about/The_Principles_of_Geotourism.html?id=KznuzQEACAAJ

Cooray, P. G. (1987). *An introduction to the geology of Sri Lanka* (2nd ed.). National Museums of Sri Lanka. https://books.google.com/books/about/An_Introduction_to_the_Geology_of_Sri_La.html?id=9xTbAAAAMAAJ

ISSN: 2513-2768

Cooray, P. G. (1994). The Precambrian of Sri Lanka: A historical review. *Precambrian Research*, *66*(1-4), 3–18. https://doi.org/10.1016/0301-9268(94)90043-4

Dissanayake, C. B., & Jayawardena, D. E. (1993). The geology, mineralogy and rare element geochemistry of the gem deposits of Sri Lanka. *Journal of the Geological Society of Sri Lanka*, *5*, 23–36. https://www.researchgate.net/publication/41484832_The_geology_mineralogy_and_rare_element_geochemistry_of_the_gem_deposits_of_Sri_Lanka

Dowling, R. K. (2011). The evolution of geotourism. *Geoheritage*, *3*(1), 1–13. https://doi.org/10.1007/s12371-010-0024-7

Dowling, R. K., & Newsome, D. (Eds.). (2006). *Geotourism*. Elsevier Butterworth-Heinemann. https://ro.ecu.edu.au/ecuworks/1802/

Dahanayake, K. (1982). Geomorphology and geology of the Rakwana-Deniyaya area. *Journal of the National Science Council of Sri Lanka*, *10*(2), 153–161.

Edwards, D. (2007). *Sustainable tourism and local communities*. *International Journal of Economics, Commerce & Management*, *6*(4), 1–15. Retrieved from https://ijecm.co.uk/wp-content/uploads/2018/04/6415.pdf

Hose, T. A. (1995). *Selling the story of Britain's stone*. *Environmental Interpretation*, *10*(2), 16–17. Retrieved from https://www.scirp.org/reference/ReferencesPapers?ReferenceID=952589

Katupotha, J., & Sumanarathna, A. (2020). Geotourism and geoheritage potentials: Vistas and unique opportunities of Sri Lanka. *WildLanka*, *8*(2), 51–64. http://dr.lib.sjp.ac.lk/bitstream/handle/123456789/9131/2020%20Paper%202020%20-%20GEOTOURISM%20Wild%20Lanka%208%20%2C2.pdf

National Geographic Center for Sustainable Destinations. (2010). *Application for Geotourism Charter* [PDF]. The George Washington University. https://www2.gwu.edu/~iits/Sustainable_Tourism_Online_Learning/Jen/Charter_Application_blank.pdf

Newsome, D., & Dowling, R. K. (2010). *Geotourism: The tourism of geology and landscape*. Goodfellow Publishers. https://www.semanticscholar.org/paper/Geotourism%3A-the-tourism-of-geology-and-landscape-Dowling-Newsome/b7b983d300976c9e65be06f3b189e334600d117d

Pathmasiri, E. H. G. C., & Fernando, S. L. J. (2022). An exploration of geotourism characteristics: A case study of the Hummanaya blowhole in Kudawella, Sri Lanka. *The Faculty Journal of Humanities and Social Sciences*, *11*(1), 1–15. http://www.hss.ruh.ac.lk/JFHSS/Vol11Iss2/Volume%2011%20Issue%202_Paper%203.pdf

Pathmasiri, E. H. G. C., & Fernando, S. L. J. (2023). A comparison of the expected and performed roles of the geotourism stakeholders at Hummanaya, Sri Lanka. *Journal of Asian Geography*, *2*(2), 66–72. https://doi.org/10.36777/jag2023.2.2.9

Pathmasiri, E. H. G. C., & Fernando, S. L. J. (2024). Stakeholders' opinion on the geotourism characteristics of Hummanaya destination, Sri Lanka. *Journal of Asian Geography*, *3*(2), 37–48. https://doi.org/10.36777/jag2024.3.2.4

Pathmasiri, E. H. G. C., & Fernando, S. L. J. (2025). *Hummanaya: Geotourism* (in Sinhala). Cultural Center, University of Ruhuna.

Pérez-Romero, M. E., Álvarez-García, J., Flores-Romero, M. B., & Jiménez-Islas, D. (2023). *UNESCO Global Geoparks 22 years after their creation: Analysis of scientific production*. *Land*, *12*(3), 671. https://doi.org/10.3390/land12030671

Perera, P. K. U., & Wasantha, H. L. N. (2025). *Geodiversity as a driver of tourism: A study of Sri Lankan geological heritage*. *International Journal on Recent Trends in Business and Tourism*, *9*(1), 43–57. https://doi.org/10.31674/ijrtbt.2025.v09i01.005

Ranasinghe, R., & Cheng, S. (2020). Tourism in Sri Lanka during political, economic, and environmental crises: A qualitative analysis. *Journal of Environmental Management and Tourism*, *5*(2).

ISSN: 2513-2768

https://journals.aserspublishing.eu/jemt/article/view/8875

Ruban, D. A. (2015). Geotourism's global growth. *Tourism Management Perspectives, 15*, 1–6. https://www.researchgate.net/publication/285669931_Geotourism's_global_growth

Ranasinghe, R., Herath, J. P., & Subasinghe, P. (2021). *Geotourism as a tool for tourism development in Sri Lanka: An exploration*. *Journal On Tourism & Sustainability, 4*(2). https://journal.ontourism.academy/index.php/jots/article/view/101

Sinopoli, C. (1994). *Sri Lankan prehistory revealed* [Review of the book *The Prehistory of Sri Lanka: An Ecological Perspective*, by S. U. Deraniyagala]. *American Anthropologist, 96*(4), 986–987. https://doi.org/10.1525/aa.1994.96.4.02a00260

Thamodi, A. A. R., & Sumanajith Kumara, B. A. S. (2025). *A geomorphological study on the micro karst landform diversity of a limestone cave: A case study of Waulpane Cave, Ratnapura District*. *International Journal of Latest Technology in Engineering Management & Applied Science, 14*(5), 534–552. https://doi.org/10.51583/IJLTEMAS.2025.140500056

Acknowledgement:

It is noted that ChatGPT was used in this study for the purpose of correcting grammar and improving readability.

.