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Improving the Potential of Ecotourism in Kerala by Practicing Sustainable Architecture

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Abstract: Ecotourism is a form of tourism that has been gaining more popularity because of increased sensitivity towards nature among people. Ecotourism is the most complete form of sustainable tourism. It means responsible travel to natural, pristine, and protected areas, conserving the environment and culture, and improving the well-being of the local people and local economy. Kerala is one of the fastest-growing states of the country in terms of tourism and has been applauded over the decades for its sustainable tourism model. The state boasts of 56 ecotourism spots and is working towards their protection, and local & tourist awareness. The aim of this study is to identify and improve the relationship between ecotourism & architecture, the factors that exert influence on this interaction, and uncover the knowledge gap in relevant policies and strategies for the development of ecotourism and its related architecture through sustainable strategies. The core idea of ecotourism lies in architecture as it has the power to express the environment and culture through space. This study uses different methods of research to establish and

analyze its aim and discover new possibilities for ecotourism with the help of architecture. Qualitative and quantitative methods of research have been used to establish the meaning of ecotourism, sustainability, and architecture. The research is exploratory and descriptive in nature. Two types of surveys have been used to collect data for analysis - Closed surveys and open-ended surveys along with one-to-one interviews. Through such methods, the research critically reviews the status & ecotourism policies in Kerala. It establishes the need for mindful design interventions to support the infrastructure required. Use of locally sourced natural materials, passive solar and energy-efficient strategies, improving cultural identity through space, and minimal environmental impact are some of the ways in which design can make ecotourism better. Eventually, this will help generate more local employment, foreign currency in the local communities, and state, cultural, and environmental awareness.

Keywords: Ecotourism, Kerala, Sustainable architecture, Vernacular Architecture, Community development, Conservation

1. Introduction

1.1 Ecotourism

The environmental movement of the 1970s gave birth to ecotourism and other types of sustainable travel. Ecotourism did not become a popular vacation concept until the late 1980s. Increasing environmental consciousness and a desire to travel to natural settings rather than developing tourist destinations made ecotourism appealing in recent times.

Ecotourism is a type of tourism that involves visiting fragile, pristine, and largely undisturbed natural regions, with the goal of becoming a low-impact, small-scale alternative to traditional commercial mass tourism.

Eco-tourism is the most complete expression of sustainable tourism. It necessitates going to natural regions responsibly, saving the environment, and enhancing the well-being of the locals. It typically involves travel to destinations where flora, fauna, and cultural heritage are the main attractions. Its goal is to provide visitors with a better understanding of how humans affect the environment and to encourage a greater appreciation for our natural surroundings. Ecotourism has the potential to change the attitude of its host society toward the environmental, social, and economic issues that have arisen as a result of capitalism's development.

The broad goal of ecotourism is to create experiences that benefit everyone, not just the tourists & stakeholders. This includes protecting the local ecosystem and natural resources. It also involves giving local people a living wage while helping them preserve their communities and culture. While the goal is simple, the execution is not. There are many factors and opposing needs that are involved. To make it easier, this is a set of needed criteria for achieving ecotourism.

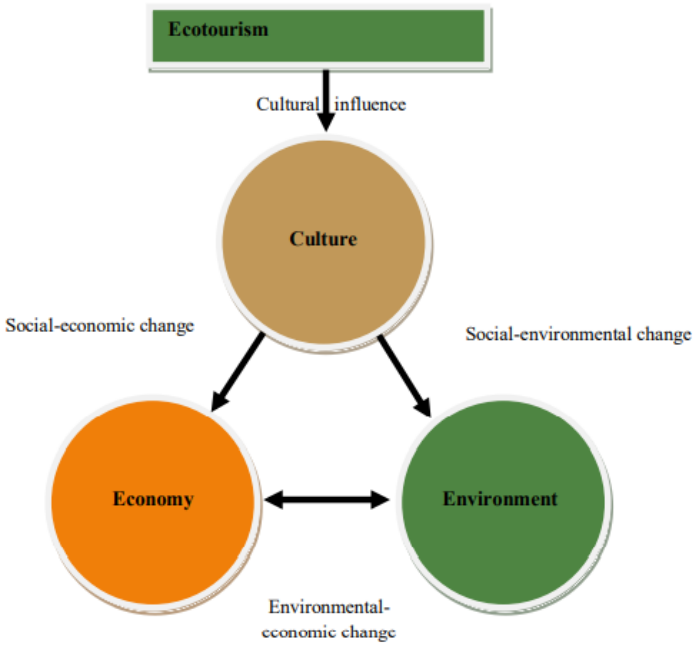


Figure 1: Relationship between ecotourism, the culture of the host society, environment, and economic system

Economical & cultural awareness

One of the main goals of ecotourism is to increase the awareness tourists have about the social and economical conditions surrounding a travel destination. Ecotourism aims to expose tourists to the realities of an area. Ecotourism educates travelers on the interdependent relationship between conservation, sustainability, built infrastructure, and the real-life of local communities.

Benefit for the local community

The next goal of ecotourism is that it should be beneficial to the local community. The way of doing this is by donating some of the profit back to the local community and by employing the local people in infrastructure projects. Obviously, their basic human rights should be respected.

Benefit for the environment

The ecotourism initiative should have a clear benefit for the environment as well. Part of the profit generated by the ecotourism companies/resorts/centers should go into nature conservation efforts. The activities, structures, and accommodations made should also leave a minimal carbon footprint on the earth. Using sustainable materials and sources of energy is one way of achieving this.

Human rights and democracy

Ecotourism should also strive to support human rights, economic empowerment, and democratic movements in host communities. This political aim of ecotourism is the most contentious and often the hardest to define clearly.

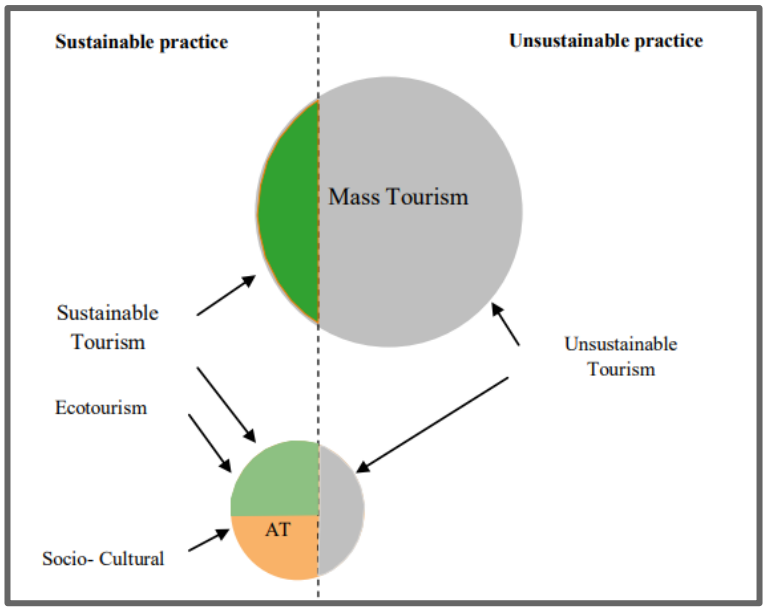


Figure 2: The perceived relationship between sustainability, mass tourism, alternative tourism (AT), and ecotourism

People universally think that ecotourism is fast developing, according to a survey done by The International Ecotourism Society (TIES, 2015). Only 4 out of 971 respondents, or less than 0.5 percent, believed ecotourism was slowing. The rest agreed that ecotourism is on the rise, and it's on the rise quickly. Travel agents, travelers, tourism officers, researchers, tour operators, media and marketing workers, hotel and attraction owners/managers, students, non-profit organizations, and national/international tourism boards from all over the world were among the participants interviewed.

Ecotourism in India

According to a survey conducted by a leading travel company, 97% of Indians want to travel sustainably and to ensure as low an impact on the environment as possible.

- The sustainable activities enjoyed by Indians are buying locally made products (69%),
- Using public transport instead of a taxi (62%),
- And eating local food (61%).

About 75% feel motivated by natural sights including backwaters, coral reefs, rainforests, and also the impact of ecotourism on the local community.

1.2 Ecotourism in Kerala & its policies

Kerala is an Indian state located in the southwest region of India on the Malabar coast having a diverse coastline of 580 km. The state has everything from deep forests, backwaters, and pristine waterfalls, to hill

stations. It is mostly known for its destinations and scenic beauty for tourists.

It is an excellent example of ecotourism because it was built around boat houses, temple architecture, and scenic beauty. The most well-known of these are Kerala's boat homes, which have boosted the economy while simultaneously preserving the nature of the backwaters of Alleppey, Alappuzha, and other areas. Kerala ecotourism strives to provide visitors with an understanding of the local culture, flora and animals, and environmental conservation. With each passing day, ecotourism, along with pilgrim, backwater, and village tourism, is boosting this area to new heights. With two national parks and 12 animal sanctuaries, it covers a protected area of 2,324 square kilometers. The development of ecotourism in Kerala's the Western Ghats, with its tropical forest ecology, offers tourists a natural advantage. Kerala's tourism industry is one of the key contributors to the state's economy. Changes in the market forces as well as move toward environmentally sensitive and sustainable forms of tourism offer the maximum potential for the promotion of ecotourism in Kerala.

Kerala tourism follows a **sustainable tourism model** adopting various suitable parameters. Kerala believes in qualitative tourism attracting a limited number of visitors who are high spenders and who value local culture, community, and environment. Kerala has been awarded for its **sustainable ecotourism policies by the UN** and is soon to be declared the **world leader in responsible tourism in 2022.**

The World Tourism Organization has designated **Thenmala as a premier eco-friendly project** in Kerala. It is India's first planned Ecotourism destination. Kerala tourism follows a sustainable tourist approach that incorporates a number of appropriate parameters. Kerala believes in high-quality tourism, attracting a small number of high-spending visitors who appreciate the local culture, community, and environment. Kerala is India's ecotourism leader, and it's setting a great example for the rest of the country. Kerala has also been recognized by the United Nations for its sustainable ecotourism regulations and is set to be named the world leader in responsible tourism in 2022.

In Kerala, 56 locations have been recognized as potential ecotourism destinations (Figure3), with a focus on conservation, ecological sustainability, environmental education, and local community benefits. A dedicated eco-tourism wing has been established to provide policy assistance for the development of the state's eco-tourism hotspots. The state's ecotourism model states the requirement of **eco-sensitive resorts, ecotourism centers, backwater resorts, deep woods environmental education centers, interpretation centers**, etc.

There is quite clearly an imbalance between the geographical spread of tourism assets and tourism development. While all varieties of tourism assets are spread out fairly uniformly across different parts of the State, the more popular tourist destinations are concentrated in the southern and central regions. North Kerala receives less than 5 % of total tourist arrivals to the State.

Sl.No	District	No. of Destination
1	Thiruvananthapuram	6
2	Kollam	3
3	Pathanamthitta	5
4	Alappuzha	0
5	Idukki	9
6	Kottayam	2
7	Ernakulam	3
8	Thissur	2
9	Palakkad	6
10	Malapuram	3
11	Kozhikode	5
12	Waynad	12
13	Kannur	3
14	Kasargode	1
	Total	60

Figure 3: Ecotourism destinations in Kerala

Kerala's Tenth Five Year Plan proposals for tourism suggest the following broad pattern of allocation across different regions of the State:

1. Southern Kerala (Thiruvananthapuram, Kollam, Pathanamthitta & Alappuzha districts) : 40 %

2. Central Kerala (Kottayam, Idukki, Ernakulam, Thrissur & Palakkad districts) : 45 %

3. Northern Kerala (Malappuram, Kozhikode, Wayanad, Kannur, and Kasaragod districts) : 15 %

Clearly, North Kerala can help in reducing the damaging effects of tourism by balancing the footfall by building eco-infrastructure there. Low-density resorts and other developments can take place primarily in the interior highlands.

A few of the **Kerala government's policies for 2025** are mentioned below:

a. Quite clearly, all new tourist facilities should be created outside the protected area boundaries. This would eliminate the prime cause of conflict.

b. Tourism in forest areas is prone to be ecologically sensitive, and one has to tread with caution,

with continuous monitoring of the costs and benefits. Further, forest and wildlife-based tourism would have to be encouraged on a conservative level, and therefore cannot be expected to generate large-scale employment and income generation.

c. As Kerala is an ecologically sensitive state, appropriate pollution control norms must be formulated at the state level in association with the State Pollution Control Board, so that all tourism projects of significant magnitude are brought under scrutiny. Implementation of these norms may be accompanied by a system of local-level participation and public hearing for clearing projects that are above a certain scale. This will ensure that only projects appropriate to a given place are set up, thus addressing issues of economic, socio-cultural, and ecological/environmental impacts in one go.

d. The numbers and quality of facilities would have to be regulated, keeping in view the local carrying capacity in different places of tourist concentration.

e. Minimize adverse socio-cultural and environmental impacts of tourism.

f. Safeguard the security and health of the host population and also those of the tourists.

g. Integrate with the overall development objectives of the State, and promote balanced development, without creating over-dependence on tourism.

h. Disperse economic development, to the extent applicable and possible, to the less developed regions of the State.

1.3 Sustainable architecture and its relation with ecotourism

Architecture has the potential to express environment and culture through space, which is why it is at the heart of ecotourism. Architecture and tourism are two activities that are strongly linked. They both rely on one other in some way. As a result, the study's goal is to evaluate Kerala's eco-tourism potential by employing sustainable architecture and design. To reduce the environmental impact of tourism by thoughtful interventions utilizing context-oriented architecture. The architecture supports ecotourism because it blends in with the environment and conveys the local unspoiled life through a user experience. It aids in raising awareness of existing resources, craftsmanship, and culture of a certain location, as well as supporting the economics and identity of the area.

Architecture is viewed as one of the ecotourism products that can contribute to sustainable development through ecotourism. In addition, architecture is part of the social products that contribute to the interaction between society and its surrounding environment towards being **sustainable through using spaces, materials, and renewable sources of energy in a sustainable way.**

The main cultural outcomes for architecture used as one of the ecotourism products are the same as the anticipated cultural outcomes for sustainable development of ecotourism. These outcomes include awareness of people about their cultural and environmental capitals and heritage and engagement of local people in the

sustainable development process through the architecture used in ecotourism development.

Vale and Vale (2009:10) discuss the two models for portraying the meaning of sustainability; the **'weak model' and the 'strong model' of sustainability**. According to Vale and Vale (2009:10) in the weak model of sustainability, the three main components of sustainable development, the environment, human society, and the economy are represented by three intersecting circles of equal size and values.

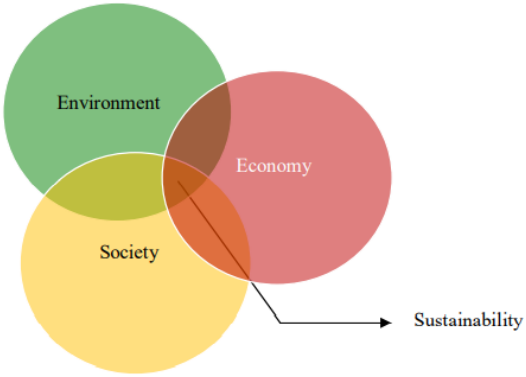


Figure 4.1 Weak Model of Sustainability

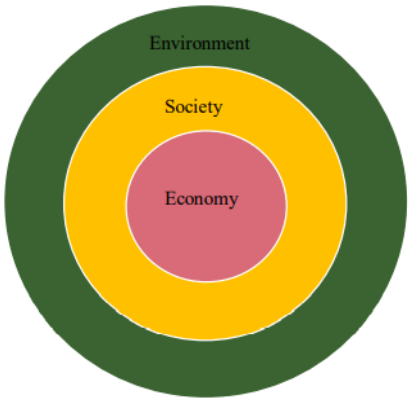


Figure 4.2 Strong model of sustainability

In the weak model of sustainability (Figure 4.1), the three main components are portrayed as competing interests so that the degradation of one can be compensated for by the improvement in another. In the strong sustainability model, as explained by Vale and Vale (2009:10) the environment is considered as a circle in which society as a base for human activities is set (Figure 4.2). In this model, the environment is considered as the main foundation, which strongly exerts influences on society, culture, and all their subsectors such as the economy, architecture, politics, art, etc.

1.4 Knowledge gap

Since the term "Ecotourism" has become very popular recently, it is being overused and misused in numerous cases, many pseudo-eco tours are being set up, pretending to be "green operations", but in reality, they are only seeking profit, without engaging in no real environmental consciousness. In other cases, projects with the intention of being "eco touristic" have failed because the training aspects were neglected, the active involvement of the local communities was not achieved, local landscape and ecology were not preserved, or for a number of other reasons. Not everything about ecotourism is on the bright side. There are some problems as well. Many tourist "mega-projects" continue to be rampant in many countries, especially in beach environments, with their well-known ravaging effects on the natural and cultural environment. One example is the pristine beaches of Lakshadweep Islands, India. But genuine, well-planned ecotourism projects are definitely becoming more and more real and popular everywhere, and hopefully, they will establish new trends for the 21st century, in which all human activities will have to be of a sustainable nature.

A knowledge gap also exists in terms of frameworks and strategies for the sustainable development of ecotourism and its related architecture. This knowledge gap can be further described as a lack of a comprehensive framework that has the ability to integrally consider the ecological, cultural, and economic influences exerted by ecotourism and its architecture on a given host destination. Moreover, there is a

deficient link between expected activities and each forecasted outcome and an absence of efficient cultural and economic indicators that can be used to evaluate ecotourism and architecture as being culturally and economically sustainable.

2. Case Studies

This research paper uses three case studies, namely, Banasura Hill Resort, Wayanad; Ulaman Eco Resort, Bali; Ecotourism Centre, Franchard biosphere Reserve, France to understand the study and analyze the existing ecoresorts in Kerala and what sustainable measures they take to contribute towards the social, economical, ecological and environmental aspects of ecotourism.

2.1 Banasura Hill Resort, Wayanad

Banasura Hill Resort is a nature resort in the Wayanad District of North Kerala, India. It stands on a 35 acres (14 ha) plot amidst the mountains of the Western Ghats declared as one of the traditionally preserved sites in the world by UNESCO.

The resort's architectural design follows construction based on reusable natural materials and the major material is rammed earth. It is made of 95% mud and only 5 % cement has been used to stabilize the mud. The living structures within the resort complex are constructed using mud excavated from the site on which it stands. The main building has an area of nearly 20,000 square feet spread over two floors (31 rooms, huts, suites, restaurant, coffee shop, conference hall, Ayurvedic spa, Reception, library, gym, STP, Bio-gas plant) and is made entirely out of mud, with a lightweight roof of bamboo and coconut palm fronds. Local tribes were called in for labor and their expertise in building with mud was also tapped.

"The basic concept is that there should be no damage to the environment in any manner. Whatever material is used for construction should return to earth after lifecycle without damaging the environment." (Eugene Pandala, 2010)

No air conditioning is needed as the mud walls are good regulators of heat and cold. These structures can balance fluctuation in the temperatures throughout the year. Recycled wood has been used for much of the woodwork. Curvaceous forms have been used to correspond the to existing landscape and terrain of the site. Planning is done in a way that the window openings are in front of each other and allow for cross ventilation. Smaller inlets paired with larger outlets increase wind velocity in the interior space. Large trees have been planted along the windows to avoid the harsh low-angle sun.

2.2 Ulaman Eco Resort, Bali

Located in Bali, this wellness eco-resort has been integrated into a forest that borders lush rice fields on one side and a river on the other. The river converges water from the whole area creating a junction of small waterfalls that produces enough flow to power a hydroelectric generator that can sustain the power of the buildings within the complex.

The approach to the design has been to merge with nature, not just by its operation but by using materials found directly on the site and the immediate locality, therefore making the resort **fully carbon zero.**

This resort Utilises **bamboo structures** sustainably harvested from nearby areas with no waste & use of recycling. The walls are made from **rammed earth, recycled wood** has been used for roofing, and **bamboo** for the rest of the structure. All materials are locally sourced with a low carbon footprint. They maintain the natural environment designed to accommodate the existing greeneries.

They have preserved the Balinese culture and people from the village work in the resort. Induced natural ventilation technique has been used by giving openings in the roof arch that allows for hot air to rise keeping the interior cool. Open interior spaces with minimal partitions allow for cross ventilation at body level. Water bodies around every structure help in daytime cooling.

2.3 Ecotourism Centre, Franchard Bioreserve, France

The site the “gorges de Franchard” is the most popular among the forest massif of Fontainebleau (the biggest listed site in France). This very sensitive site is of high quality within the new nature reserve. The very first Eco-tourism center within the île de France’s goal is the better management of the traffic flow of the area as much as the public awareness of its great fragility.

Oriented to optimize solar gain and keep the structures warm without undue mechanical help, the center is organized around a reception and exhibition area and a hall where educational activities will be held.

The building is thought of as a living room in the woods. Its wide and smooth shapes gently wandering along the preserved trees are inspired by the eroded stones seen on the site. As a true dialogue between architecture and nature, the project draws new boundaries between publicly accessible grounds and fragile forest soil with limited access.

The **orientation** choices and the protection from the main winds optimize the **bioclimatic solutions** and the eco-friendly energy sources used. The use of **wood** and its implementation gives the opportunity for eco-construction solutions. **Superficial foundations** ensure the project's reversibility. The comfortable and functional space offers a high degree of flexibility depending on the season and the attendance rate.

It looks neat, but in addition to using materials from sustainable and non-toxic sources, there should have been a goal to minimize the amount of material needed, and to maximize the useful space such that there is no space wastage. A lot of these designs look good, but they also have a lot of wasted space, nooks that become unusable, and thus, extra material that has gone to waste.

3. Architectural Measures for Eco-Sensitive Design

From the literature study and case studies, different sustainable strategies and materials have been found common and successful in designing an eco-sensitive sustainable structure, especially for Kerala. These strategies and materials when incorporated into the design will result in minimal impact on the site flora and fauna, habitats of animals, and the natural terrain of the site.

3.1 Sustainable Strategies/Techniques

a. Facade articulation:

• Orientation of smaller side of structure along with the east-west direction

• **North-south orientation** for max. air movement

• High density of façade that is open and yet shaded.

• Faint/pale colors on outer surfaces

• Building materials with insulating/reflecting properties that resist heat transfer.

b. Roofing Pattern:

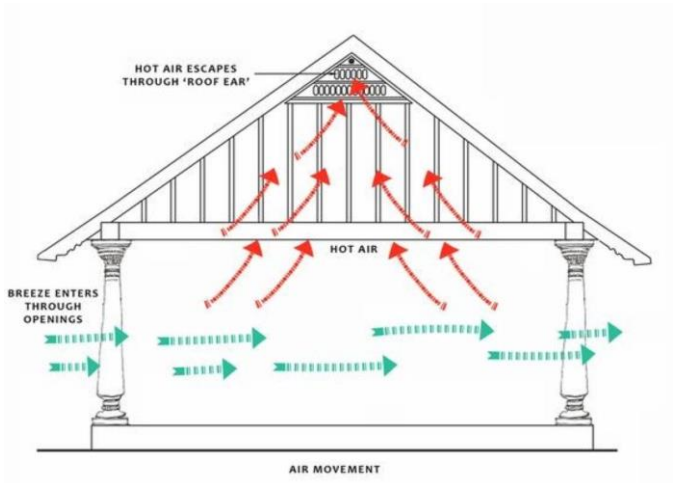
•**Voids in roofs and courtyards** provide max. light and cross ventilation with large openings to catch the breeze.

•**Light colors, natural materials,** and reflective surfaces on roofs will deflect solar radiation and keep the building cool.

•Sloping roof is a characteristic of these regions as it drains off rainwater.

•Barrel-vaulted roof can also be seen.

c. Cross ventilation:



• Being in a tropical climate, cross ventilation plays an important role in creating comfortable spaces. The presence of high moisture content in hot air causes discomfort for the user.

• **Courtyard spaces** are extensively used in houses of Kerala of all scales. It helps in achieving passive cooling and reduces the dependence on HVAC systems. It also helps to **induce continuous air movement.**

• **Openings in walls facing each other** and internal partitions help in increasing cross-

ventilation. Using **vertical louvers and large window shutters** helps to reduce thermal discomfort with ample daylight. It can save up to 25% of energy costs

d. Insulation:

- Highly insulated walls to prevent conductive heat flow
- Avoid using hard paved surfaces outside
- Walls should be of **light color** to reflect the heat
- **Filler slabs, cavity walls, double roof, and composite walls** insulate the house against heat
- The materials used should be lightweight, highly reflective, and should have a low warm limit.
- It is important to insulate the roof against sunlight and heavy rain. The **high pitched roof** of traditional Kerala structures **maximizes pressure difference** to optimize airflow.

e. Solar Shading:

- **Verandas** to avoid direct exposure of walls to the sun.
- The east and west façade should be least exposed to the sun to prevent late afternoon and early morning heat. One way is to have **dense tree plantations** around these façades.
- Minimum glass surface should be exposed to direct sunlight
- Use **overhangs, louvers, canopies**, etc. for sheltering
- Shading devices for windows and doors to avoid solar heat gain
- Traditional buildings in Kerala have an internal and external verandah which acts as **buffer space to reduce direct exposure to sunlight** whereas the internal verandah allows light to enter the building via a courtyard.

f. Fenestrations:

- Different fenestration elements can be oriented in the right direction to maximize the flow of air and thus maintain thermal comfort.
- **Jaalis** to invite **diffused air** and maintain air movement
- **Skylight in the northern facade** to bring in daylight
- Windows with maximum openable area

- **Large vents** are to allow a lot of air to pass

In the vernacular architecture of Kerala, wooden jalis, two-panel casement windows, etc. were used to maximize airflow. The small fenestrations increased the velocity of the air and allowed its deeper penetration in the inner space.

g. Berms: Berms are mounds of soil that slope into the surrounding landscape. Berms have a multitude of benefits and use ranging from drainage to beautification of landscape design. The use of landscape can integrate the built with the wider landscape with the hills or mounds. These berms create a sense of privacy in different parts of the structure.

3.2. Sustainable Materials

a. Bamboo: Bamboo has elasticity which makes it a good building material and environmentally friendly for areas with earthquakes. Bamboo has a relatively low weight and can be transported easily. Bamboo has excellent insulation properties. "Green Steel" - It is very versatile, tough, and durable along with an astounding lifespan. Bamboo fibers are naturally anti-bacterial so no need for any toxic chemical treatments. Due to its ability to produce new culms or poles each year, when they reach four to seven years old they can be harvested without affecting the rest of the clump, unlike a tree that is killed for its wood."

b. Mud: Mud is found in abundance in almost every part of the world. This attribute makes it cheaper than any other conventional building material. - Due to the abundance, easy availability, and lesser use of energy-consuming construction equipment, it directly reduces the energy consumption. The recycling of soil does not require the input of any external source. Therefore, saving a lot of time and money. The properties of recycled soil post-construction are the same. Mud as an insulation material prevents external heat from entering the building while maintaining a cool environment inside because it is porous.

c. Rammed Earth: The thick walls that builders create using soil and clay can retain heat during the day, and then slowly release it at night. They are naturally soundproofed because of their density. Earth walls are highly durable and versatile. Provides flexibility in terms of shape, color, and finish. It is highly fire and moisture resistant. Rammed Earth has low embodied energy making it a sustainable material that reduces the structure's overall carbon footprint. It is recyclable i.e. can be used post demolition. The construction period is longer than the average time. Soil needs to be tested before for its durability before usage.

d. Terracotta: Terracotta is 100% natural. The base material is clay, which is a naturally occurring material. Terracotta construction is cost-effective. The process of manufacturing terracotta is simple and natural, as it does not involve any harmful chemical treatments. Terracotta can be recycled with a recyclability rate of 95 percent. Because of its low thermal diffusivity, i.e. it limits the heat penetration inside, the indoor temperatures are stable and comfortable in summers. It is non-combustible and has natural sound absorption properties.

e. Palm Leaves: They're renewable, low-carbon building materials. They are widely available and inexpensive, especially in the humid tropics. But it is not a good choice compared to more durable and less combustible coverings. Skills are widely known where palm leaves are available and are easily learned. Palm thatch is light in weight, so roof timbering need not be very expensive. Their thermal insulation value is high, so palm leaf roofs are comfortable in warm climates. This type of roof looks attractive, it blends well with the natural environment and is ecologically sound.

f. Laterite Blocks: One of the main uses of laterites for construction purposes is the production of Compressed Earth Blocks (CEB). The production technology for CEB provides a modern use of lateritic soils for walls and meets the building requirements for structural performance. In addition, high esthetic quality of buildings can be achieved. In Kerala, the foundations were usually built with laterite blocks. Its compressive strength can be higher than that of burnt bricks. Laterite can be called the "Blessing of Kerala" since 80% of the state is covered with it.

g. Lime: Lime Allows Buildings To Breathe It is vapor permeable. Porous and open-textured materials such as lime plasters, help to stabilize the internal humidity of a building by absorbing and releasing moisture. This makes for a more comfortable environment.

- Lime has less embodied energy than cement.
- Free lime absorbs carbon dioxide in the setting process of carbonation.
- It is possible to produce lime on a small scale.
- The gentle binding properties of lime enable full re-use of other materials.
- A very low proportion of quicklime will stabilize clay soils.
- Small quantities of lime can protect otherwise vulnerable, very low energy materials such as earth construction and straw bales.

Its characteristics allow lime mortars to protect adjacent materials by handling moisture movements through the building fabric. Lime Binders Can Be Durable And Have Stood The Test Of Time When used carefully, lime is exceptionally durable. Local Limes Enhance Regional Identity And Diversity. The diversity of limestone types provides variety and local distinctiveness. Different limes will vary in color, texture, and setting properties. Local limes have a regional identity, they give a sense of place and provide a continuous link with the local aesthetic.

h. Straw Bale: From very early times, straw has been used as a building material: mixed with mud and clay, or as a roofing material. Straw has excellent insulating properties; the massive structure of the straw bale absorbs large amounts of heat and radiates it constantly into the room. This minimizes heat loss and provides a pleasant indoor climate. Because the straw bales replace bricks, insulation, and facade material, the result is a simpler building technique. The basic methods can be learned in a few days. This reduces labor costs considerably. Since the straw is an agricultural by-product, it is cheap and available in most regions of the world, with little or no transportation cost.

i. Hemp: It is an excellent heat and sound insulation material. It is lightweight, fire-resistant, and preserves a high level of breathability. It is resistant to mold as it is moisture absorbent (one

square meter of hemp wall absorbs up to 14 liters of water, which can be released into the ground and/or be collected and recycled). It is microbe and insect resistant; It is a carbon synthesizer and tackles pollution by reducing CO2 emissions during the construction process. It is 100% recyclable at the end of its life cycle and is biodegradable. It is economic: adding to its insulating property which heavily contributes to energy saving, a hemp-based building can cost up to 20% less compared to those built with current techniques.

4. Quantitative Research

The research methodology for this research paper includes two types of research: Qualitative and Quantitative. For the Quantitative research, a questionnaire survey was conducted along with an interview to gather primary data from eco-resorts in Kerala and architecture students from the state. Sustainability experts, managers, and bio-conservationists at 3 resorts were interviewed (namely, Coconut Lagoon; Kumarakom, Banasura Hill Resort, Wayanad; and Thenmala Ecoresort) and the direct output was analyzed. Government survey statistics and sustainability reports from a few resorts were also analyzed.

4.1. Questionnaire Survey & Interview

30 responses from ecoresort managers, conservationists, and students of architecture were recorded and they are as mentioned below:

Ecotourism is no longer an alien term and people are very well versed in its meaning, effectiveness, and objectives of it. Although there is still some slight misconception about the actual definition of the term. 13% of respondents feel that it is responsible travel to popular tourist destinations while the remaining 77% understand that ecotourism is responsible travel to the protected natural and pristine areas, travel that sustains the well being of the locals and the environment, spreads awareness, and educates people. 66.7% of people believe that pollution: noise and air along with waste pollution is the most negative impact of ecotourism in such destinations. According to the remaining, other negative aspects of ecotourism are disruption of habitats, Profits not helping the local communities, Risk of collapse and erosion, etc. Meanwhile, when asked about the positive impact of ecotourism, most respondents to the questionnaire feel it has the potential to empower local communities, Creation of jobs and additional income, nature conservation, Economic and regional diversity, and Spread awareness among locals and tourists. 93% say that they are confident about ecotourism-sensitive architecture for the future.

40% believe that the Kerala government is taking the right steps in achieving the goals set by them to make tourism eco-friendly in the state and that their framework is achievable and practical. While the remaining 60% say otherwise. According to them, the framework on paper is not happening on the ground. A person from Thenmala Ecoresort, Kerala says that " there is always some bureaucracy involved and there are delays. But the authorities are very cautious and attentive in our case, we work closely with the government." Kerala government has also organized various awareness programs over the last decade or so, and 70% of respondents say that they have succeeded in spreading awareness about ecotourism and achieving the desired

developments to support ecotourism development. The rest 30% do not agree with the same.

Umesh Pavundy from the Coconut Lagoon Resort, Kumarakom (on-call interview, 28 March 2022) says that "local people are employed and they benefit from the eco-development in some areas where there is more awareness. Many ecotourism centers and resorts train and employ the locals". 13% deny the above. 80% of respondents share their opinion on ecotourism centers, resorts, and nature adventure activities in these areas and that they are required but need improvement and sensitive design. Everything at these sites is limited. Tourism does not need to drain the resources of the destination, but it can be a positive force helping to sustain the local way of life. These areas need to be protected in many ways. It all depends on how fragile the ecotourism centers we are referring to. Some places are always good with minimal architectural intervention. Some of the resort authorities say that they use local materials available on-site and in nearby areas. The local community actively engages in the construction process. The labor is local and knows how to build with natural materials. They do not rely on modern technology for the construction, the methods are purely vernacular. Personal vehicles are not allowed inside the periphery of the eco-sensitive sites like the Thenmala village. Limited occupancy is kept in eco-resort/center to avoid the overburdening of such sensitive places. They maintain and preserve the local ecology and landscape with the help of farmers using age-old techniques.

For designing, respondents say that they use a variety of architectural techniques and materials to improve the experience of the users and at the same time work towards the ecotourism goals. Windows and openings are on the east side so we get the morning sun, greenery around the structures has been maintained, Trees were not cut so shade from trees on the west and south side provide shade, and thatch has been used for roof with a double layer of heat insulation. There are garden fountains, courtyards, terracotta roofs, and resorts designed in wind orientation. Mussel farming, Floating cottages, use of renewable energy are some other measures taken by them to improve the water quality of the place by using proper waste management methods. They use old techniques to preserve the ecology and celebrate with the local tribes. 93% of respondents want to stay in vernacular structures saying that they feel closer to nature in these settings. 86% say that such architectural strategies and reusable materials that can be mounted and demounted as per need do help in conserving the areas. When asked about the comfort level inside structures made of local and natural materials, they were elated to say that the temperature inside is comfortable keeping in my the humidity in Kerala. 60% do not feel any difficulty living in them while the remaining feel such structures ended regular maintenance as natural materials age over time. Mr. Rajesh Vijayna (Banasura Hill resort, on-call interview, 15th April 2022) says that "structures made from the earth have sustained for centuries. Humans have been living in huts made from the earth for eons and it is the best local material. It is a renewable building material that is simply borrowed from the earth for the life of the building and can be recycled indefinitely as a building material or returned to the earth. The thermal mass of the earth used in construction can be used to store both warmth and coolness, thus balancing diurnal fluctuations in temperature throughout the year. What is most important is the ambiance that the interiors of an earthen structure provide; the feeling of comfort and wellbeing that one gets to feel while inside; and the soundness of the sleep that you get to enjoy when you spend a night in an earthen room. These we believe are best appreciated when one experiences living in an earthen space."

4.2 Umesh Pavukandy, Naturalist and Eco-Conservationist, Coconut Lagoon, Kumarakom, Oncall Interview, 28th March 2022 -

"Ecotourism as a concept is completely okay if done well and architecture can support it only if the site is respected and no changes are done to the landscape and habitats, otherwise it is a gimmick. **Littering and waste management** is the biggest negative impact. **Satisfaction with the government policies:** No. Policies are there but no enforcement, calls ecotourism ecoterrorism due to the negligence of large % of authorities and eco-resorts towards the environment, lack of awareness, hampering animal's natural habitat, littering by tourists, there are people who are working towards the betterment but it is less compared to the % of damage. **Community involvement & development:** Local labor from the vicinity built the structures and some people have been employed as staff.

Materials :

-bamboo piles for foundation (loose soil due to presence of lagoon) and stone plinth
-wood (teakwood, redwood) for walls and roof structures (taken from abandoned structures in the state)
-roof material: clay tile / Mangalore tiles
-Mud plaster and an elevated platform made of concrete

Experience: Internal temperature less compared to exteriors (, it is comfortable, very less need of air conditioning (needed for people due to high humidity)

Sustainable strategies on site :

-use of landscape as it is without any leveling
-No drastic change to the ecosystem because no hindrance to the natural habitats has been done through design
-The majority of the rooms are column less to reduce the need for concrete
-The majority of the windows face the shore for better air movement
-The soil used for the site excavation
-Rainwater harvesting in 50 lac liter capacity tanks + for recycled sewage water

Waste Management:

-Zero waste: convert biowaste to use in fish farming and vegetable garden
-Biogas plant: animal waste - cooking
-Recycled wastewater
-Water bottling plant: reducing the use of plastic bottles, water is filled there in the reusable bottles to use in the resort
-Sewage treatment plant: wastewater is recycled and used in irrigation."

4.3 Sundarlal Sundaram, General Manager, Thenmala Eco-resort, Oncall Interview, 28th March 2022 -

According to him, the concept of ecotourism is in favor of nature and he agrees with the objectives of the concept. He says **Waste management** is the biggest challenge in eco-sensitive areas.

Satisfaction with the government policies: Acc. to Mr. Sundaram, Kerala govt. works closely with the Thenmala resort, vehicles permitted in the area only after checking, no personal vehicles allowed, govt vehicles to enter the estate, but there are delays in the government plans, which is obvious because there is always bureaucracy involved in these projects.

Community involvement & development: Local labor from the vicinity built the structures and more than 60% have been employed as staff.

Materials :

-Rubber estate: that wood has been used for construction while it was being cut.

-Stones have been collected from a nearby railway project where they were disposed of them.

-Roof: double layer insulation and thatch for covering

Experience: Internal temperature 2-3 degrees less than the external area.

Waste management: Wet waste is processed in-house and dry waste is collected by the local agency.

Sustainable strategies:

-Solar panels generate electricity to reduce the load on the grid

-Water is recycled and reused for irrigation and washing.

-Most of the windows are on the Eastside.

-Have maintained the slope and vegetation of the site

-No personal vehicles are allowed in the vicinity of the borders, checked closely by the government of Kerala.

5. Key Findings & Suggestions:

The findings from the research have mentioned below broadly:

1. There is an imbalance between the geographical spread of tourism assets and tourism development. While all varieties of tourism assets are spread out fairly uniformly across different parts of the State, the more popular tourist destinations are concentrated in the southern and central regions.

North Kerala receives less than 5 % of total tourist arrivals to the State. Clearly, North Kerala can help in reducing the damaging effects of tourism by balancing the footfall by building eco-infrastructure there. Low-density resorts and other developments can take place primarily in the interior highlands. New eco-resorts can be proposed and built in the northern region to regulate overall distribution.

2. As mentioned above in 1.3, a strong model of sustainability should be followed for each and every step. The environment should be considered as a circle in which society is set. In this model, the environment is considered as the main foundation, which strongly exerts influences on society, culture, and all their subsectors such as the economy, architecture, politics, art, etc.

3. As mentioned in 1.4, a knowledge gap also exists between the authorities and people, in terms of frameworks and strategies for the sustainable development of ecotourism and its related architecture. This knowledge gap can be eradicated by a comprehensive framework that has the ability to integrally consider the ecological, cultural, and economic influences exerted by ecotourism and its architecture on a given host destination.

4. Since a lot of 'said eco resorts' are not purely eco-sensitive, there are a few that set an example and emphasize the possibility of achieving the said goals with proper integration of awareness among people, effort, and love for nature through sustainable practices in building and maintaining these areas. Some of these eco-resorts have been mentioned above in section 2.

5. Through case studies and literature review, it was found that various sustainable strategies in designing and building prove to be efficient in preserving the eco-sensitive areas by not disturbing the local flora and fauna, building away from animal habitats, not changing the natural terrain and landscape of the site, using resources available within 5kms of the site, etc.

6. During the qualitative study, it was found that the policies set by the Kerala government are not fully sustainable and most of them have not been implemented to their full potential. In some areas, there have been certain changes and awareness among people but overall across the state, there is a lack of awareness to some extent. A lot of these political frameworks focus on earning through tourism rather than preserving them.

7. Many tourist "mega-projects" continue to be rampant in many countries, especially in beach environments, with their well-known ravaging effects on the natural and cultural environment. One example is the pristine beaches of Lakshadweep Islands, India. But genuine, well-planned ecotourism projects are definitely becoming more and more real and popular everywhere, and hopefully, they will establish new trends for the 21st century, in which all human activities will have to be of a sustainable nature.

8. Waste management is the biggest issue faced by authorities and resorts. The waste needs to be collected, separated, and sent out of these ecozones to the waste management and recycling plants. A number of measures can also be taken as mentioned in 4.2 and 4.3.

Ecotourism cannot achieve its agenda unless and until proper policies and frameworks are in place, they are implemented and maintained across the state, and most importantly until we do not build sensititvely using sustainable strategies.

6. Conclusion

The relationship between architecture and ecotourism is not yet defined and clarified. There are no direct works written on architecture's relationship to ecotourism, even though some focus separately on both categories through discussion of sustainability. There are many examples of ecotourism resorts, or what are claimed to be ecotourism resorts, throughout the world. The truth is that true ecotourism resorts are very few and far between. Even though many destinations claim to have eco-friendly accommodation for ecotourists, there are still no criteria that define what architecture has to be for consideration as part of ecotourism.

Architecture and tourism have been closely related activities. Universally, they both rely on each other. The core of the idea of ecotourism lies in architecture as it has the power to express the environment and culture through space.

Ecotourism is supported by architecture as it amalgamates with surroundings and represents the local life with a user experience. It helps to generate awareness of existing resources, craftsmanship, and culture of a particular place as well as works as a support to the economy and identity of the space. Ecotourism is a sub-component of the field of sustainable tourism. Ecotourism perceived potential as an effective tool for sustainable development is the main reason why developing countries are now embracing it and including it in their economic development and conservation strategies.

The development of such sensitive architectural practices promotes ecotourism and can help put together a new way of coexistence through architectural tourism. It is time architecture comes to the forefront of this battle for responsible architectural travel and paves the way toward constructive futuristic tourism strategies.

In conclusion, ecotourism projects should not be viewed as an enterprise that will solve all issues. Consequently, related communities must integrate ecotourism with other alternative productive options to reduce the expectations placed on having one activity alone, and to reduce the tensions that arise from unmet expectations. Wang (2004:12) argues that community-based ecotourism is a "multi-dimensional productive and cultural/social system" which is not an isolated industry from other economic activities. This system will lead to stability in the economy at the national, regional, or community levels. Ecotourism is not a 'magic bullet' that will suddenly result in the conservation of natural resources at the same time as development and increased foreign revenue. It can skew development within a country, such as the development of a few places within Costa Rica for housing and servicing tourists. At best, ecotourism that gives at least part of its benefits back to the local communities that support it can have positive outcomes but these may be slow to arrive and may not meet the expectations of those involved. In some ways, the problems of ecotourism establishment can be seen as a mirror at a small scale of the problems of trying to move the whole world economy on a much more sustainable basis. Both will only succeed if those involved expect less, rather than more. For the eco-tourist, less might mean less comfortable travel and accommodation and for the local people involved, less might mean a lower level of lifestyle improvement. However, the big benefit of ecotourism is that local natural resources are conserved to a much greater extent, which is the basis for all sustainability

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