SUSTAINABILITY ASSESSMENT AND IDENTIFICATION OF ECOTOURISM SITES IN HIMACHAL PRADESH

Thesis

by

SHALINI CHAUHAN
(F-2017-10-D)

submitted to

Dr. YASHWANT SINGH PARMAR UNIVERSITY
OF HORTICULTURE AND FORESTRY
SOLAN (NAUNI) HP - 173 230 INDIA

in

partial fulfilment of the requirements for the degree

of

DOCTOR OF PHILOSOPHY
ENVIRONMENTAL SCIENCE

DEPARTMENT OF ENVIRONMENTAL SCIENCE
COLLEGE OF FORESTRY

2021

Prof. SK Bhardwaj
Head

Department of Environmental Science
College of Forestry, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, 173230 Solan (HP) - India

CERTIFICATE-I

This is to certify that the thesis entitled**, "Sustainability assessment and identification of ecotourism sites in Himachal Pradesh"** submitted in partial fulfillment of the requirements for the award of degree of **Doctor of Philosophy** in the discipline of **Environmental Science** to Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (HP) is a bonafide research work carried out by **Ms. Shalini Chauhan (F-2017-10-D)** daughter of Sh. Madan Singh Chauhan under my guidance and supervision and that no part of this thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of investigation has been fully acknowledged.

Place: Nauni, Solan
Dated:

(Prof. SK Bhardwaj)
Chairman
Major Advisor

CERTIFICATE-II

This is to certify that the thesis entitled, **"Sustainability Assessment and Identification of Ecotourism Sites in Himachal Pradesh"** submitted by **Ms. Shalini Chauhan (F-2017-10-D)** d/o Shri Madan Singh Chauhan to Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni-173 230, Solan (HP), India in partial fulfillment of the requirements for the award of degree of Ph.D in the discipline of Environmental Science has been approved by the Advisory Committee after an oral examination of the student in collaboration with the External examiner.

11/11/2021

(SS Samant)
External Examiner

11/11/2021

(MK Brahmi)
Dean's Nominee

11/11/2021

(SK Bhardwaj)
Major Advisor

Member of the Advisory Committee

11/11/21

Ravinder Sharma
Director of Research

11/11/2021

JC Sharma
Professor & Head
Department of Soil Science & Water Management

SS Randhawa
Principal Scientific Officer
State Council for Science, Technology & Environment

It is to certify that the corrections suggested by the Examination Committee have been incorporated in the thesis.

Major Advisor

Countersigned

Professor & Head
Department of Environmental Science
COF, UHF, Nauni (HP)

ACKNOWLEDGEMENT

*With immense servility, I would like to thank '**GOD**' and offer my heartfelt salutations at the Lotus feet of the Almighty who bestowed me patience, peace, understanding and courage to complete my studies successfully. I would also like to thank my "**GURUJI**", who blessed me with all the favorable circumstances to complete these investigations. Every effort is motivated by ambitions and inspirations behind; I owe this pride place to my daughter Swaratmika, Maa and my Grandparents.*

*I express my deep sentiments & regards to my speculative, prudent & dignified chairperson, **Dr. Satish Kumar Bhardwaj** Professor and Head, Department of Environmental Sciences. The piece of investigation owes its completion to his expert guidance, unending zeal, painstaking efforts & encouragement, which led to complete this task successfully. I shall remain indebted to his affection, help & generosity bestowed upon me. I would remember him more as a guardian than as a guide.*

*I convey my sincere and heartfelt gratitude towards the esteemed members of my advisory committee, **Dr. Ravinder Sharma** (Director Research, YSPUHF) for his kind insight into statistical and socio-economic aspect of the study, **Dr. JC Sharma** (Head, Department of Soil Science and Water Management) and **Dr. SS Randhawa** (Senior Scientific Officer, State Centre for Climate Change, Shimla). I emphatically express my loyal thanks to, Dr. MS Jhangra, Dr. Rajiv Agarwal, Dr. MK Brahmi, Dr. PK Baweja, Dr. HC Sharma and Dr. Pratima Vaidya for their invaluable help as & when needed.*

My veracious thanks are due to office, laboratory and field staff of Department of Environmental Science especially Dr. JK Sharma, Mr. Keshav, Mr. Jitender, Anita, Sh. Amrit Lal, Mr. RajKumar and Mr. Bansal for their help and cooperation. The cooperation and assistance provided by Mrs. Balbir Kaur in processing all the academic matter cases is highly appreciated.

My sincere thanks to all the staff members of Himachal Pradesh State Forest Department, ECOSOC (Ecotourism Society of Himachal Pradesh), Department of Tourism and Civil Aviation for helping me in data/information collection. Special thanks to Sahil Sood for guiding me in all the work related to remote sensing and GIS.

*It is a sumptuous occasion for me but words betray to express my heartfelt sentiments towards the three towering peaks, **Swara, Apurva** and my aunt **Kusum** who's amiable, ineffable, unforgettable company, selfless love and youthful insouciance acted as a vital source of my mental strength and inspiration. There is no substitute for the help, support, care, love and affection bestowed on me by them. I would also like to express my gratitude to my family, Dr. RS Shandil, Mrs. Meera Shandil, Dr. Kamini Shandil, Dr. Neeraj Shandil, Mrs. Deepika Thakur and Dr. Dhiraj Shandil for the constant support and motivation.*

I would like to voice my deep admiration and deeper love to, Swarit, Soham, Shivi, Ama (Mrs. Somi Bharadwaj), Papa (Sh. Surender Bharadwaj), Tanu Bhaiya, Prashant, Radhika, Aunty G, Sidhu Bhaiya, Neelam Bhabi, Reena Bhabi, Harry, Parry, Biku and Shashi for their wishes, everlasting love & care. I am also thankful to my parents for their help.

Friends are born not made. God was benevolent enough to bless me with the adorable company of my lovely friends Krishna (my best friend), Meera, Diksha (my one and only wonderful Ph.D batchmate), Nisha, Monika, Raheli, Yamini, Shweta, Dr. Reetika, Dr. Tanvi, Dr. Radhika, and Sharmila for their constant help, encouragement and valuable suggestions and my lovely juniors, Purnima, Surbhi, Kirti, Shivani, RK, Upasana and Kavita,

Language seems to be inadequate media to express my sincere thanks to Dr. KK Sharma (PI-IDP) and all the members of team IDP for their help, support and encouragement during the crucial period.

I sincerely express my gratitude to DPT COMPUTERS NAUNI Solan for typesetting this manuscript in beautiful shape.

I solely claim the responsibility for the shortcomings & limitations in this work.

***Place:** Nauni-Solan*
Date:** 16th November, 2021* ***(Shalini Chauhan)

CONTENTS

LIST OF ABBREVIATIONS

%	:	Per cent
.csv	:	Comma-separated Values File
.shp	:	Shape file
/ha	:	Per hectare
°C	:	Degree Celsius
AHP	:	Analytical Hierarchy Process
amsl	:	above mean sea level
BOD		Biological Oxygen Demand
CAGR	:	Compound Annual Growth Rate
CD	:	Critical difference
COD	:	Chemical Oxygen Demand
EC	:	Electrical Conductivity
ECOSOC	:	Ecotourism Society of Himachal Pradesh
et al.	:	And others
etc	:	Etcetera
FAO	:	Food and Agriculture Organization
FSI	:	Forest Survey of India
GIS	:	Geo Information System
IPH	:	Irrigation and Public Health Department
IUCN	:	International Union for Conservation of Nature
MCDs	:	Municipal Corporation Dumps
PPP	:	Private Public Partnership
SDG	:	Sustainable Development Goals
SoER	:	State of the Environment Report
SWOT	:	Strength Weakness Opportunities Threats
TDS	:	Total Dissolved Solids
TIES	:	The International Ecotourism Society

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF PLATES

Chapter-1

INTRODUCTION

Tourism is a major engine of economic growth, an important source of employment and foreign exchange earnings in many countries including India. It is an important source of revenue generation and has great capacity to create large scale employment opportunities of diverse kinds – from the most specialized to the unskilled ones (Economic Survey, 2020-21). Tourism is one of the fastest growing industries in the world and in India it is the third most important sector that has long played an important role in the Indian economy and contributed 6.23% to the national GDP and 12.75% to the total employment (MoT, 2019). The impacts of tourism are highly diverse, from an economic viewpoint, tourism is heralded as bringing income to local communities, but from an ecological standpoint, tourism poses a threat to sensitive environments (Williams and Fennell, 2005). Unless, attention is paid now for developing tourism in ecologically sustainable manner and maintaining environmental integrity, it may cause irreparable damage.

Nature-based tourism referred to as ecotourism provides a sustainable alternative to conventional tourism and has continued to gain momentum over the last two decades. Ecotourism is receiving more attention among conservationists as a means to promote both environmental preservation and income generation and is considered to be growing three times faster than the tourism industry as a whole. But while growth in the popularity of ecotourism maybe beneficial monetarily, the growth of "the global tourism industry often does so at the expense of the social and ecological integrity of destination regions" (Fennel and Dowling, 2003). This nature based approach to tourism is becoming so popular that it is believed to become 'mainstream' tourism activity within a decade (Economic Survey, 2020-21). The potential of eco-tourism as a strategy for sustainable development was recognized during the Earth Summit in 1992. The summit outcome indicated sustainable tourism as an environment-friendly economic activity (Gray, 2003). Ecotourism is being increasingly viewed by local and indigenous communities as a crucial tool for promoting cultural preservation, biodiversity conservation, sustainable livelihood and local economic growth (Honey, 2008).

Ecotourism in its broadest sense, concerns travel to a natural area involving local people, bringing economic profit into local environmental protection and contributing to the

maintenance of the environment through minimizing visitor impact and promoting tourist education (Diamantis, 2004). It is defined as environmentally responsible travel to the natural areas, to enjoy, appreciate and promote nature conservation, have a low visitor impact and provide for beneficially active socio-economic involvement of the local people (TIES, 2015). The fundamental function of ecotourism is the protection of natural and cultural resources of the area as well as income generation, education, local participation and capacity building. As per the fundamental principles it should be: nature-friendly, ecologically sustainable, environmentally educative and economically beneficial to the local community, along with offering satisfaction to the tourists (Newsome and Hassel, 2014). The new venture of ecotourism industry in much of the developing world lacks monitoring and governmental management due to both personnel and resource scarcity (Thomas *et al.* 2014). There is a strong need to study ecotourism, to develop it as part of an alternative form of tourism for the growth of low impact tourism in the area and its natural ecosystem maintenance as well as for the benefit of local population (Samanta and Baitalik, 2015). Ecotourism development is visualized as a development tool–not just in promoting tourism growth but also in reducing poverty, particularly in the rural areas. Ecotourism has been reported to exert both positive and negative impacts on economic, environmental, and social-cultural aspects of the area so, it should necessarily be developed properly by understanding sustainability indicators and assessing the carrying capacity (Nag, 2013).

Even if there is a great potential for ecotourism growth in any region, it must be managed in a way that is inclusive, sustainable and contribute to achieving the Sustainable Development Goals (SDG) specially SDG 8 (Decent work and economic growth) and SDG 12 (Responsible consumption and production). All tourism activities, whether it is motivation holidays, wellness tourism, business travels, conferences, adventure travel or ecotourism, needs to be sustainable. Sustainable tourism refers to tourism that results in development capable of sustaining the environmental quality of destinations, provides and maintains the quality of tourist experience along with satisfaction and socio-economic benefits to the local people (Samanta and Baitalik, 2015; Saarinen, 2001). Bunruamkaew and Murayama (2011) indicated that sustainability depends on the relationship between tourism and environment whose suitable management for ecotourism development is essential to conserve and maintain the biological richness of the area as well as economic upliftment of the local people. In this respect, ecotourism evaluation should be regarded as an important tool for sustainable development of the venture in an area. The World Tourism Organization has been

promoting the use of sustainable tourism indicators since the early 1990s, as an essential instrument for policy-making, planning and management processes at destinations.

The sustainability of ecotourism sites can be measured with the help of certain sustainability indicators that are measures of the existence or severity of certain issues, signals of upcoming situations or problems, measures of risk and potential need for action, and means to identify and measure the results of the actions. They are information sets that are formally selected to be used regularly to measure changes that are of importance for ecotourism development and management. They can measure changes in tourism's own structures and internal factors, changes in external factors which affect tourism and also the impacts caused by tourism. Both quantitative and qualitative information can be used for either objective or subjective types of sustainability indicators. The indicators of sustainability are not always quantifiable and may necessarily be somewhat subjective; this limitation does not in any way detract from their utility as management information in promoting sustainable tourism (WTO, 1993). The selected indicators should ensure that the three most important spheres of sustainability are covered i.e. environmental, socio-cultural and economical. They should cover a wide range of spheres from the satisfaction of local communities and tourists, to the management of available resources like water, land, energy, waste, employment, etc.

To regulate and manage the resources available at ecotourism sites for sustenance, carrying capacity assessment of a tourism venture is essential. Each tourist destination on the basis of the available area, its location, climatic conditions, tourist engagement activities and managerial staff, has its own carrying capacity to accommodate visitors without causing irreversible damage to the surroundings (Coccossis and Mexa, 2004). Carrying capacity refers to the number of individuals (people, animals or crops) which can be supported by a region without any environmental degradation and is determined so that relevant tourism should be managed in an area, not to break the regenerable recovery capacity of the ecosystem (Lee, 2011). In terms of sustainable ecotourism, carrying capacity checks the number of tourists whose presence does not have a negative impact on either the environment or the local cultural assets. The balance between ecological damage loading and recovery capacity forms the basis of carrying capacity in sustainable tourism. Available natural resources are an asset to the ecotourism venture and water is the most important one. It is also necessary to regularly monitor the quality and status of these naturally available resources through various measures like quality analysis.

Further, in order to help community development through generation of livelihood for local people ecotourism should be strengthened through identification of more potential ecotourism areas which are plenty in the mountains of Himachal Pradesh. Due to lack of knowledge and publicity amongst the tourists about the lesser known and more potential ecotourism sites in the region, the crowd mostly visits the well known and developed destinations. In order to deviate tourists from the major tourist attraction areas to lesser known destinations and to create awareness amongst the tourists regarding environment conservation and responsible tourism, more potential ecotourism sites need to be identified. This will further strengthen and help in expansion of the ecotourism industry, Modern scientific tools, techniques and technologies like remote sensing and GIS can be utilized for the purpose to develop the state into an ecotourism hub.

Ecotourism resource in any areas could generate more revenues, which could benefit the local people and contribute to conservation of the areas (Holden, 2003). Mismanaged tourism however, could lead to consequences that could include, but are not limited to: forest degradation, soil erosion, waterway pollution, loss of biodiversity, environmental degradation due to the waste generated, and an overburdening of infrastructure and sanitation systems (Wood, 2002). Simultaneously, a mechanism has to be evolved to make a strategic framework for sustainable ecotourism development in the state. Development of this newly arising industry requires extensive research and planning, without proper strategy, the benefit from this industry cannot be equally distributed among all segments of ecotourism related stakeholders. Therefore, it is quintessential to develop sustainable ecotourism to resolve environmental, social and economic problems of the area. Considering the above issues it is necessary to examine different strategic factors of ecotourism industry using certain tool such as SWOT (strengths, weaknesses, opportunities and threats) analysis.

Himachal Pradesh forms a key and central part of the Indian Himalayan Region acting as a mystic magnet for tourists; in turn, tourism has proved to be the backbone of the state's economy by contributing around 12.45% to the GDP during 2010-2015 and about seven per cent in 2019 alone which is quite significant, tourism sector did well in 2019 and witnessed a 4.63 per cent growth in arrivals of both foreign and domestic tourist (Niti Aayog, 2018; Economic Survey, 2020-21). Himachal Pradesh is a major tourism destination and tourism has been contributing greatly to the growth, development and economy of the state. The state plans to increase employment in the tourism sector to 12% of the total employment generation and the share to the state GDP to 8.5% in the coming years. Keeping in view the

role of tourism in revenue generation and livelihood of people, the state government has strengthened this industry by laying more stress on maintenance of environmental integrity and developing tourism in an ecologically sustainable manner. This is evident as the state has its own ecotourism policy framed in 2005 and re-revised in 2017 consequently. Domestic as well as international tourist inflow has been increasing in the last many decades because of various government initiatives and slogans like "Himachal for all seasons and reasons", to further attract tourists to promote tourism in the state with an overall average of around 1,60,42,225 during 2010-2015 (Niti Aayog, 2018).

Increase in the number of tourists visiting the state every year, makes it mandatory to study the impact that tourism activities have on the sustainability of the natural resources and further initiatives required to improve the sector and make it more viable. By increasing local capacity building and employment opportunities, ecotourism can prove to be an effective vehicle for empowering local communities to fight against poverty and to achieve sustainable development without environmental degradation. With an emphasis on enriching personal experiences and environmental awareness through interpretation, ecotourism promotes greater understanding and appreciation for nature, local society, and culture. But at the same time this new venture that has emerged in the state has to be assessed for sustainability and viability. As well there is a need to develop more potential areas as ecotourism destinations for even distribution of tourists and economic growth. For sustainable development of ecotourism in the mountainous terrain of Himachal Pradesh, it is essential to study its various characteristics in detail and formulate any plans accordingly. Therefore, the present study entitled **"Sustainability Assessment and Identification of Ecotourism Sites in Himachal Pradesh"** was undertaken with following objectives:

Objectives

i) Sustainability assessment of existing ecotourism sites.

ii) Identification of new potential ecotourism sites using remote sensing and GIS in Himachal Pradesh.

iii) Formulation of strategies framework for sustainable ecotourism development in the state using SWOT technique.

Chapter-2

REVIEW OF LITERATURE

Pertinent literature has been scanned to gather information and idea on the importance and role of ecotourism, environmental implications related to the activity, importance of its sustainability, need of identifying new sites and strategic development of ecotourism. The information available on the literature pertaining to the present study has been reviewed in this chapter under the following headings:

2.1 Concept, status and importance of Ecotourism
2.2 Ecotourism and Sustainability Assessment
2.3 Ecotourism Potential Area Identification
2.4 Strategic Development of Ecotourism

2.1 CONCEPT, STATUS AND IMPORTANCE OF ECOTOURISM

The origin of nature travel is truly old, during the 19th century, nature travel was essentially a quest for spectacular and unique scenery. During this time, the concept of national park was created, and while the main objective of setting national parks was to protect the environment rather than provide tourism facilities, but the tourists provided the economic and political rationale needed to translate philosophy of nature protection into accomplishment (Butler, 1992). Not until the mid-20th century did worldwide travel become possible for more than just the elite. The technological revolution in communication and transport sector permits several people from different parts of the world to undertake trips to remotest destinations previously inaccessible to the common traveller.

However, there was a growing emphasis being placed on the social, environmental and cultural aspects of tourism since its inception. The critical observations of past practice gave way to a new vision of future tourism planning. Notions of ‘sustainable development’ that was raised in the Brundtland Commission’s report on environment and development in 1987 found widespread support during the 1990s. The idea that economic growth could serve to stimulate development and at the same time protect the environment appealed to governments, academics and many organizations. While ‘sustainable development’ was not intended to be a planning tool, it was looked upon as a technique catalyst for promoting

discussion on how development and environment can be balanced (Wall, 1997). The philosophy was well suited to tourism and had a major influence on how tourism planning should be done. This is evident, in the proliferation of 'alternative' forms of tourism, including community-based tourism, cultural tourism, sustainable tourism, nature-based tourism, and ecotourism, etc., which occurred during this period.

It was in the late 1980s when the term ecotourism emerged as a direct result of the world's acknowledgment and reaction to globally sustainable ecological practices. Ecotourism was regarded as a niche based product that was a specialized form of nature or adventure tourism. This niche concept changed in the early 1990s, and ecotourism became a popular term, in terms of its definitions, applications, importance and evaluation stemming from the viewpoint that ecotourism was a 'politically correct form of mass tourism'. By the mid-1990s ecotourism entered a state of maturity as a result of the marketing practices of certain operators, as well as from the results of certain studies centering on ecotourism elements and ecotourists' characteristics. This enabled the concept to enter into its consolidation stage, where there was an emphasis on redefining the concept based on its exclusive characteristics, emanating from an understanding of certain attributes from ecotourists' experience process (Lindberg and McKercher, 1997; Lindberg *et al.*, 1998).

Though there exist many proposed definitions and concepts for ecotourism, "the contradictions and constraints that are embodied in many definitions of ecotourism confirm its general inoperability". It has been so difficult to construct a universally accepted definition of ecotourism, that both Bjork and Higham (2007) believed it to be futile. Despite these opinions, the 2002 World Ecotourism Summit declared ecotourism important for the development of responsible tourism but was underestimated, and thus neither the development of ecotourism ventures nor their study has been stunted. Because of the subject's ambiguity, most ecotourism researchers and authors begin their work by establishing a definition of ecotourism upon which they build their discussion. Though these definitions differ, the majority have several key concepts in common.

Tourism is a sector made up of many subcategories, such as nature tourism, agrotourism, anthrotourism, safari tourism, academic tourism, wilderness tourism and more (Leung *et al.*, 2015). Ecotourism is one fraction of tourism that challenges many aspects of mainstream/mass tourism. Ecotourism is a sustainable form of natural resource-based tourism

that focuses primarily on experiencing and learning about nature, and which is ethically managed to be low-impact, non-consumptive, and locally oriented benefits (Yilmaza, 2013).

Ecotourism was first defined by Hector Ceballos-Lascurain in the early 1980s (Das and Chatterjee, 2015) as "tourism that involves travelling to relatively undisturbed natural areas with the specific objective of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural aspects (both past and present) found in these areas. Ecotourism implies a scientific, aesthetic or philosophical approach, with the main emphasis on the point that the person who practices ecotourism has the opportunity of immersing him or herself in nature in a way that most people cannot enjoy in their routine and urban existence."

Despite its roots in the early 1980s, a definition for ecotourism agreed upon by all has yet to be found, although there are some frequently used in ecotourism literature. Two frequently cited definitions are put forward by The International Ecotourism Society and the Quebec Declaration of Ecotourism. TIES defines ecotourism as "responsible travel to natural areas that conserves the environment and improves the well-being of local people" (Fletcher, 2015). The Quebec Declaration of Ecotourism developed as part of the 2002 United Nations International Year of Tourism, defines ecotourism as "tourism that contributes actively to the conservation of natural and cultural heritage including local and indigenous communities in its planning, developing and operations, contributes to the well-being, interprets the natural and cultural heritage of the destination and is a treat to independent travellers, as well as to organized tours of small group sizes."

The World Conservation Union (IUCN) Commission on National Parks and Protected Areas defined it as environmentally responsible travel and visitation to relatively undisturbed natural areas, to enjoy and appreciate nature and any accompanying cultural features that promotes conservation, has low visitor negative impact and provides for beneficially active socio-economic involvement of local populations (Ceballos-Lascurain, 1996). According to Ross and Wall (1999), ecotourism is often seen to be a potential strategy to support the conservation of natural ecosystems while at the same time promoting sustainable local development. It is evident from the definitions above that, through the introduction of ecotourism, natural areas and local populations are united in a symbiotic relationship. Ecotourism can thus be viewed as a means of protecting natural areas through generating revenue and through environmental education and the involvement of local communities in

both decision making and benefit sharing. Therefore ecotourism is an important means by which conservation and development can be promoted sustainably.

Wallace and Pierce (Vishwanatha, 2015) suggested and opined that any tourism will be true ecotourism if it addresses six principles namely: it entails a type of use that minimizes negative impacts on the environment and the local people, it increases the awareness and understanding of natural and cultural systems and the subsequent involvement of visitors in issues affecting systems, it contributes to the conservation and management of legally protected and other natural areas, it maximizes the early and long-term participation of local people in the decision-making process that determines the kind and amount of tourism, it directs economic benefits to local people that complement rather than overwhelm or replace traditional practices, it provides special opportunities for local people and employees to utilize and visit natural areas and learn more about the wonders that other visitors come to see.

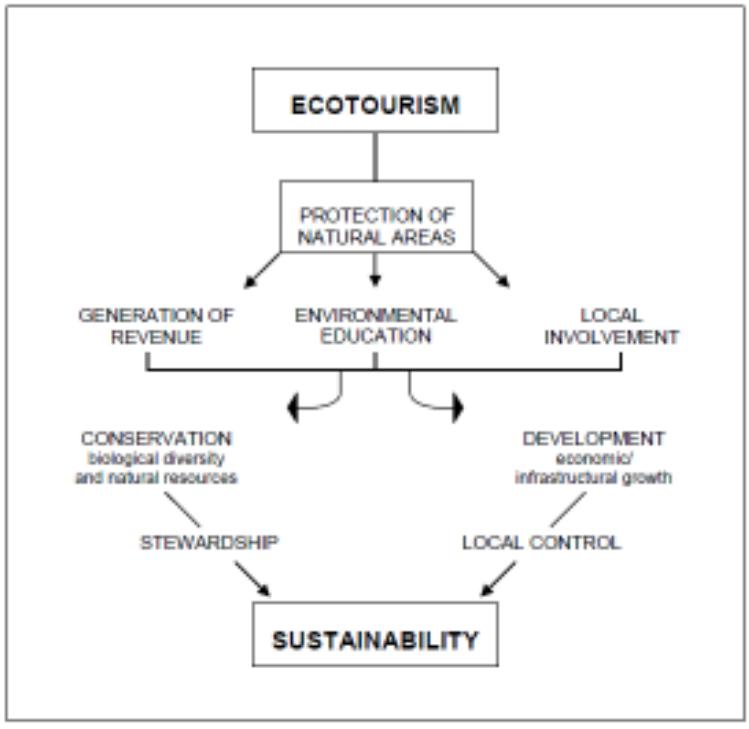


Fig 2.1: Relationship between ecotourism and sustainability (Ross & Wall, 1999)

Further ecotourism is divided into two categories: hard and soft ecotourism. Hard ecotourism is categorized as more active and catering to small groups with few services and comforts provided (Singh *et al.*, 2007). It caters to visitors with a solid knowledge of conservation looking for longer stays and seeking more specialized trips and activities (Eagles *et al.*, 2002). Hard ecotourism is typically associated with areas not easily accessed

through conventional tourism, such as coastal reefs and mountainous regions (Duffy, 2002). Soft ecotourism, on the other hand, promotes more convenience and comfort for the tourists who prefer shorter stays and more outside services to ensure their comfort.

Tourism, community and conservation are the three important aspects of ecotourism. These three aspects have to be taken into consideration with every decision that is made so as not to affect any one of these three aspects negatively while benefiting the others. The ideal situation would be one in which all three aspects benefit while none is disadvantaged in any way. Boo (1993) argues that ecotourism will not be successful without effective management. In an attempt to address Boo's concern, Ross and Wall (1999) added a fourth aspect to this relationship, involving management, protected area policies and the involvement of a wide range of organizations, such as non-government organizations (NGOs), conservation organizations and development aid agencies. Management practices, therefore, act as a catalyst between the three core aspects thereby maintaining a symbiotic relationship to ensure sustainability.

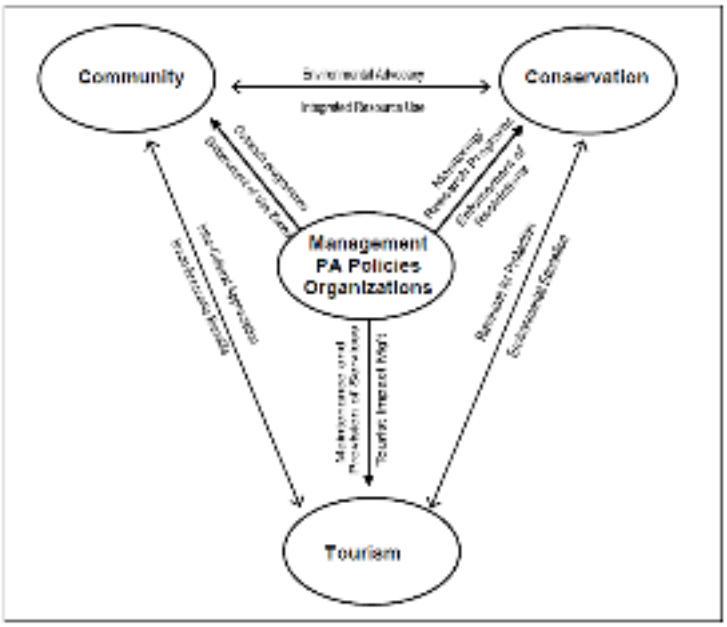


Fig 2.2: Conceptual framework for ecotourism given by Ross & Wall, (1999)

The three core components of ecotourism are illustrated in Fig 2.2. In the centre are the catalysts, namely management, protected area policies and organizations, such as NGOs, that assist in making ecotourism a success. The success of ecotourism depends on how these three components interact with one another. In an ideal ecotourism situation, local communities, conservation and tourism are linked through a symbiotic relationship.

Demand for ecotourism is increasing as tourists are more interested in the promotion and development of sustainable practices while they travel (Center for Responsible Travel, 2016). This stems from an increase in global awareness of environmental issues and people's desire to adopt sustainable habits. Supporters of ecotourism praise its ability to aid the conservation of natural resources and protected areas while contributing to the sustainable development of local communities. Critics are quick to point out how ecotourism falls short of these accomplishments in various case studies. Much research has been done to offer suggestions to promote the benefits of ecotourism while minimizing its negative aspects.

The main reasoning behind ecotourism as a form of conservation is that impoverished communities rely on natural resource degradation for their livelihoods. For conservation to be successful it must tackle poverty elimination (Pegas *et al.*, 2013). Ecotourism acts as an alternative to environmentally degrading livelihood methods, contributing to both conservation and sustainable community development (Usher and Kerstetter, 2014). Increased human interference in ecologically fragile areas can cause irreversible changes in the existing ecological processes. This necessitates methodical management of ecotourism destinations, which can minimize the impacts from ecotourism activities while offering benefits to the local communities. This can be made possible by adopting the ecosystem approach of ecotourism development, which can adopt tourism as a means to protect the environment and, in turn, sustain biodiversity.

Ecotourism is a travel to delicate, unspoiled and usually protected areas that strives to be low impact and (often) small scale. It helps educate the traveller, provides funds for conservation, economic development and political empowerment of local communities and fosters respect for different cultures and human rights. Ecotourism is very important so that future generations can experience the wonderful environment we have today (Martha, 2008). Environmental education for both local communities and visiting ecotourists is a necessary aspect of ecotourism and can have positive effects on conservation (Sander, 2012). Environmental education programs in local communities can raise awareness of the benefits of conserving natural resources and help develop positive attitudes towards conservation (Reimer and Walter, 2013).

Job provision for local communities is the most cited contribution of ecotourism towards sustainable development (Snyman, 2014). Ecotourism can create both direct employment, such as tour guides, ecolodge employees or cooks, and induced employment in

sectors impacted by ecotourism (Wearing and Neil, 2009). Employment in ecotourism is one of the more reliable sources of income and can allow residents to earn more than other livelihood methods (Novelli and Gebhardt, 2009). According to research by the University of Utah, the growth in the travel and tourism industry continues to outpace that of the global economy annually, leading by a 4.6% margin in 2018. Travel and tourism are human-resource intensive which creates new jobs and accounts for 10.4% of global GDP. “The annual growth rate for the tourism industry in India is predicted to be 8.8% between 2011 and 2021 by the World Travel and Tourism Council (Anonymous, 2020).

In addition to a job, the provision of ecotourism can contribute to the development of a local community’s infrastructure. Proper infrastructure is necessary for ecotourism (Panasiuk, 2007) as without well-developed infrastructure an ecotourism project runs the risk of leading to environmental degradation and failing to meet its objectives. For example, an area without a sustainable energy source leads to an increased demand for unsustainable fuels such as firewood.

The global market for ecotourism, a small scale alternative to mass scale tourism, has exhibited double-digit growth since the early 1990s. In the next couple of years, the market is forecasted to expand further to account for almost a quarter of the global travel market by taking forward good practices. Beginning in the 1990s, ecotourism has been growing 20% - 34% per year (TIES, 2006). As noted by the WTO, rapid growth has been experienced during the past decade regarding the size of the ecotourism market. Currently, most nature tourists at some sites and for some activities are foreigners. For example, Chudintra (1993) reported that 90% of Thailand's jungle tour clients are foreigners, however, domestic visitation predominates at many sites. Campbell (1994) reported that about 90% of visitors to Indonesia's national parks are domestic tourists, while Chudintra reported that the percentage of such visitors in Thailand increased from 58% in 1986 to 85% in 1990. Though estimates of ecotourism's growth are rare, due to the conceptual problem, most observers feel that ecotourism has grown faster than tourism generally during the past several years. Based on a survey of ecotourism operators in the region, Laarman and Gregersen (1996) found that average annual growth rates have been steady at 10-25% over the past few years, and many are projecting higher growth in coming years.

In India also the ecotourism industry is flourishing, the Ministry of Tourism in the country has created several lists of guidelines for tourists traveling in India. One set of

guidelines, “Do’s and Don’ts for Ecotourism,” includes items on cultural values, pollution, and proper disposal of waste. Another list generated by the Ministry of Tourism, “Golden Rules When You Travel,” involves similar themes. Some different items include buying from local business owners and being aware of the culture and policies of the area. These lists are meant to create awareness of how tourists affect the surroundings. Thus, the government is beginning to utilize sustainable tourism practices. Himachal Pradesh the third largest state in the mountainous Himalayan region in northern India offers an array of tourism activities, such as camping, hiking, trekking, fishing (angling), wildlife sanctuaries, nature tours, rafting, and cultural and religious visits. A unique aspect of tourism in Himachal Pradesh is the existence of widespread religious tourism. Many domestic visitors come to the mountains to worship at religiously significant locations and temples (Niti Aayog. 2018).

Himachal Pradesh Department of Tourism & Civil Aviation proposed to develop ecotourism at existing camp sites during the year 2000. They proposed establishing trekking trails, rain-shelters, and bird-watching towers. They later stated that the registration process for village tourism will be simplified, and small village tourism units that meet their criteria will receive a luxury tax subsidy. Five years later, the department listed that they offered “a rare conglomerate of ecotourism, pilgrimage, adventure, culture, heritage, leisure and wilderness” as a strength. The Indian Ministry of Tourism and the Ministry of Environment and Forests also have a set of general principles of ecotourism for the establishments. These general principles include topics like community involvement, low environmental impact, educational aspects of tourism, and stimulating the local economy (SoER HP, 2015)

The state government of Himachal Pradesh also has a list of guidelines for ecotourism that are considerably more specific. For example, these guidelines state that the use of wood as fuel is prohibited unless used for a campfire and bought from a Ministry of Environment and Forests booth. The policy states principles, similar to those listed in the best practices, which the guidelines are trying to meet. Specifically, conservation training for employees is one of the major concerns, along with the education of visitors. In efforts to promote sustainability, there is a ban on dumping and burning non-biodegradable waste in protected areas. In addition, the policy states that ecotourism sites should aim for fifty percent of their energy consumption to come from renewable sources.

The state government has also been working extensively with the Ecotourism Society of Himachal Pradesh. ECOSOC is an independent body that works with the State Tourism

and the Forest Department. Their aim is "to preserve and protect the natural, historical and cultural heritage of Himachal Pradesh" with the objective to increase awareness of the cultural and historical heritage of Himachal Pradesh. Along with the Forest Department, these two bodies are responsible for the majority of ecotourism activities within the state.

Ecotourism is an important form of the sustainable tourism industry that focuses on biodiversity conservation, environmental protection, poverty alleviation and economic development (Duffy 2008; Anup 2016 and Anup *et al.*, 2015). Among different types of tourism, ecotourism protects and conserves natural resources by employing the people (Anup and Thapa Parajuli, 2014b). It gives priority to ecological resource integrity, environmental conservation, community development and socio-economic development by maintaining low-impact and non-consumptive use of local resources (Stem *et al.,* 2003). There is a need of accessibility, liberalization, community empowerment, ecotourism facilities, nature friendly tourism products, basic accommodation and public participation for ecotourism success (Duffy, 2008; Gurung and Scholz, 2008).

Ecotourism is an alternative form of tourism that enhances nature based tourism in the biophysical environment and supports ecologically sustainable activities, conservation supporting measures and involvement of local communities (Dowling, 2000 and Sindiga, 1999). It also focuses on environmental protection, wildlife conservation, community development, poverty alleviation and traditional economic bases like agriculture and livestock (Duffy, 2008). Sustainable principles and practices in the ecotourism industry are supported by fulfilling goals of biodiversity conservation and poverty reduction; maintaining national standards of atmospheric quality, drinking water; sewage and waste management (Degang and Xiaoting, 2006; Hawkins, 2004).

It is an important aspect of ecotourism that there is a need for the preservation of cultural traditions to enrich the life quality of the local communities. It is necessary to develop and promote minority cultures to preserve cultural traditions and organize education and training programs of ecotourism and nature reserve to tourism operators, employees, locals and tourists (Genzong *et al.,* 2007).

2.2 ECOTOURISM SUSTAINABILITY ASSESSMENT

UNESCO defines sustainable tourism as "tourism that respects both local people and the traveller, cultural heritage and the environment". Sustainable tourism seeks to provide

people with an exciting and educational holiday that is also beneficial to the people of the host country. Ecotourism on the same line is sought to minimize environmental impact, maximize respect for host cultures, maximize economic benefits to the host area and maximize recreational satisfaction to participating tourists (Higham, 2007). It can also play an important role in achieving growth with equity and sustainability (Anonymous, 2018).

The impact of ecotourism studies has three dimensions; environmental, economic and socio-culture. These dimensions are recognized through a different understanding of ecotourism stakeholders. Ecotourism has different impacts and that may be divided into two major types - positive and negative. Positive impacts have always been analyzed from the views of benefits provided to the destination in different form such as conservation of the destination; economical, social and cultural development of the local communities related to the destination whereas negative impacts are always connected to the natural resources exploitation, local culture deterioration and disturbance by ecotourism in their development.

According to Buckley (2008), Ecotourism is widely recognized for its positive impacts on the environment. Ecotourism operators and tourism lobbyists argue that it has contributed to the economic, social and cultural development of the local communities by conserving and supporting the protected areas. Ecotourists are fond of enjoying the nature, culture and development of local communities by their visit to the destination. Ecotourism operators and other tourism lobbyists have argued that ecotourism always generates benefits and supports the conservation of the destination.

Both Wheeller (1991) and Wheat (1994) express that ecotourism is considered is an economic alternative to be developed in tourism destinations. It is used to reply to the economic and environmental decline in the agriculture sectors and to help encourage the local economy. Therefore, the need for sustainable management and development is necessary, and a broad analysis of its possible impacts is considered as one of the most important steps before the full development takes place.

The development of surf tourism in Las Salinas replaced agriculture and salt harvesting (Usher and Kerstetter, 2014), and residents of the Puerto Princesa Subterranean River National Park in the Philippines have converted their fishing boat to tourist ferries as ecotourism replaced the area's destructive fishing industry (Jalani, 2012). In a case study of ecotourism in south-western Cambodia, ecotourism employment has not completely

eradicated dependence on logging and hunting as a livelihood practice, but it has helped reduced it (Reimer and Walter, 2013). Yet the fact that alternative livelihoods do not completely replace more extractive and degrading livelihoods but merely supplement them is one current critique of the success of alternative livelihood projects for conservation. Critics also state that the idea of alternative livelihoods is based on the false assumption that communities are homogenous and affect environmental degradation equally (Wright, 1996).

Ecotourism in Praia do Forte, Brazil has made local communities more aware of the value of sea turtles and has led to a decrease in sea turtle hunting (Stronza and Pêgas, 2008). Environmental education in the form of a tour guide training program for residents near Tortuguero National Park, Costa Rica has also led to an increase in environmental awareness and quality of guide services (Jacobson and Robles, 1992).

In Posada Amazonas (an ecotourism project in Peru), those involved in ecotourism gain 25% more than what they have would earned from other activities (Jamal and Stronza, 2008). Women, in particular are benefited from ecotourism job creation. While they still are concentrated in low-skill jobs, women's pay is closer to man's pay in the ecotourism sector than in other sectors (Global Report on Women in Tourism, 2011). Through the multiplier effect ecotourism also provides jobs in sectors for goods and services linked to a growing ecotourism industry, further impacting the local, regional and national economy (Ntibanyurwa, 2006).

A study of ecotourism projects in six Southern African countries shows that infrastructure developed for ecotourism benefits communities as a whole, demonstrating that infrastructure development in an area will positively impact multiple sectors regardless of the reason it was developed (Pratt *et al.*, 2011). This infrastructure also connects the local region to nearby areas, strengthening the regional economy.

Ecotourism can bring about social benefits to a local community, Scheyvens (1999) outlines four forms of empowerment that can, and should, be strengthened by properly managed ecotourism: economic, psychological, social and political. While this is outlined as part of a framework to analyze the impacts of ecotourism ventures on local communities, it can be used to establish the best case scenario in terms of ecotourism's impact on community empowerment. Empowerment can be brought about by the capacity building and community development required by sustainable ecotourism development. Ecotourism can help build a

community's organization and leadership skills, contributing to their empowerment in all four aspects of Scheyvens' Empowerment Framework (Stronza and Pêgas, 2008). Other ecotourism projects cite ecotourism's ability to help a local communities' youth population, such as through the development of language skills or other skills for future employment, as a way to empower the community's upcoming generation (Delmaro and Bursztyn, 2008).

Ecotourism can help revive the traditional culture and cultural pride of an area. An ecotourism project in Cambodia shows that tourists' effort to learn about the area's culture has led to a revival of the traditional culture in the area (Reimer and Walter, 2013). Ecotourism assigns value to cultural traditions and offers an incentive to maintain and preserve them (Whelan, 2013). As per Buckley (1999), all forms of tourism produce negative impacts on the natural environment. Ecotourism, if it is more than a marketing label, has lower per capita impacts than other forms of tourism, but these impacts tend to be concentrated in areas of the highest conservation value, especially in protected areas.

Despite the possible benefits of ecotourism, it is still an extractive activity capable of degrading the environment it claims to protect. Negative impacts can happen even at low levels of use (Farrel and Marrion, 2001). The concept of ecotourism has gradually become an important determinant of tourism development, nevertheless, it is considered more important for destinations that depend on nature as their major tourist attraction (Larson and Herr 2008). A Sustainable tourism approach may offer a higher quality tourist satisfaction, improved quality of life for locals, conservation of the environment, and enhancement of local culture (Ap and Crompton 1998; Higgins 2004; Levy and Hawkins 2009).

Many negative environmental impacts have been recorded in projects claiming to use ecotourism methods. Soil erosion, habitat alteration, air, noise and water pollution, litter, biodiversity loss, and the disruption of local flora and fauna are all recorded impacts of ecotourism. A study in Belize found that the site has degraded water quality due to erosion from walking paths and parking lots, pollution from improperly maintained pits, litter, and displacement of flora and fauna (Science Daily, 2008). Another study of eight protected areas in Costa Rica and Belize found that the most commonly reported environmental impact from visitors is trail erosion, visitor's created trails, exposed roots, illegal hunting and fishing, vandalism, graffiti, litter, water pollution, vegetation loss and the illegal collection of flora and fauna (Farrell and Marrion, 2001). Rules to manage visitor behavior may be in place, yet it does not ensure that all visitors will follow these rules and guidelines. In Namibia tourists

have set up campsites near watering holes, disrupting wildlife, and failed to follow established roads despite set rules banning these activities (Novelli and Gebhardt, 2009).

While ecotourism attempts to protect an area's natural resources, in reality, it can place further stress on it. In Nepal, ecotourism tour guides are increasing wood usage to provide fuel for tourists (Duffy, 2002). Similar experiences are reported in the Galapagos Islands, as residents increase fishing to feed tourists (Taylor *et al.*, 2003). An increase in ecotourism revenue also gives local communities money in which to buy advanced tools to exploit natural resources, such as advanced hunting, fishing and agriculture technology.

In ecotourism, negative impacts on the local culture resulting from mass tourism developments are recognized. In theory, ecotourism developments have minimum impact and are perceptive to local cultures. However, difficulties can occur in the planning, implementation and management of ecotourism reserves. According to Wearing (2001) ecotourism developments can bring several socio-cultural impacts to the communities in which the ecotourism takes place.

Ecotourism can lead to negative social impacts in host communities. Ecotourism's attempts to increase respect and appreciation of local cultures can diminish local culture, even though this culture is what ecotourists pay to see (Novelli and Gebhardt, 2009). By applying value to traditional cultures it becomes commodified, turning traditional events, rituals and even the local people themselves into a resource capable of being bought and sold (Barna *et al*., 2011). The introduction of tourist social values can further add to the distortion of local values and culture (Wearing and Larsen, 1996). An example can be seen in the increase of alcohol consumption in ecotourism areas influenced by tourists (Wearing and Larsen, 1996). Concern over diminishing cultural traditions in Namibia due to tourism caused one white farmer to set up an artificial community village on his land, with one tourist claiming "it is like visiting a zoo, but instead of animals you have people" (Novelli and Gebhardt, 2009).

Nag (2013) in his study talked about the environmental impact of tourism on Shimla and suggested measures to develop tourism in the area in an environmentally friendly way. According to the author, the present tourism trends are oriented towards the increase in the volume of tourists. The study showed that the majority of the tourists visiting Shimla are Indian tourists and they visit Shimla for mostly sightseeing and pleasure. But the majority of the respondents feel that presently Shimla is much polluted and lack proper sanitation facility.

The researcher feels that the reason for this increasing pollution in the city is unplanned, deforestation and environmental pollution. The study showed that to materialize the immense ecotourism potential of Shimla a planned approach with special consideration to protect the ecology of the region would be necessary. The author said that this could be achieved through controlling the inflow of tourists, environmentally acceptable means of transport, conservation of the natural environment to make the growth of ecotourism in the region more sustainable.

An inadequate ecotourism management plan can cause negative impacts on the community and decreasing eco-tourists' and stakeholders' environmental awareness causes severe environmental degradation that indirectly leads to natural habitat destruction. Ecotourism therefore should be developed properly by understanding few factors such as the sustainability indicators and the carrying capacity (Nag, 2013).

Bunruamkaew and Murayama (2011) indicated that sustainability depends on the relationship between tourism and the environment whose suitable management for ecotourism development is essential to conserve and maintain the biological richness of the area as well as economic upliftment of the local people. In this respect, ecotourism evaluation should be regarded as an important tool for the sustainable development of tourism in a protected area.

The sustainability of ecotourism sites is measured with the help of certain sustainability indicators. Indicators are measures of the existence or severity of current issues, signals of upcoming situations or problems, measures of risk and the potential need for action, and means to identify and measure the results of our actions. Indicators are information sets that are formally selected to be used regularly to measure changes that are of importance for tourism development and management. They can measure: a) changes in tourism's structures and internal factors, b) changes in external factors which affect tourism and c) the impacts caused by tourism. Both quantitative and qualitative information can be used for sustainability indicators.

Indicators may be categorized as either objective or subjective. Tsaur *et al.* (2006) state that objective indicators generally refer to quantitative data and the majority of them could be described through various equations. Subjective indicators, on the other hand, are based on personal feelings and attitudes and are usually qualitative. Objective indicators have

been widely used because they are seen to be more rigorous. However, the WTO (1993) states that "indicators of sustainability are not always quantifiable and may necessarily be somewhat subjective. This limitation does not in any way detract from their utility as management information in promoting sustainable tourism."

The concept of tourism carrying capacity arises from the perception that tourism cannot grow continuously in a particular region without causing irreversible damage to the locals. The concept of carrying capacity in tourism has its origins in the 1960s, when it was developed to place limits on the numbers of visitors that a tourist attraction (such as a natural reserve) or destination could cope with (Coccossis and Mexa, 2004).

Carrying capacity can be subdivided into physical (accommodation), ecological (limit up to an unacceptable or irreversible decline in ecological values) and social (maximum level of recreational use up to which decline in the quality of the recreation experience) (Pigram 1983). Calculation of physical carrying capacity should serve as a starting point from which the assessment of overall recreational carrying capacity can proceed (Wilkinson 1995). As the amount of space in areas is fixed, the only opportunity to increase physical capacity will lie in the development of management parameters aimed at more complete or efficient utilization (Shelby and Heberlein 1984).

Some definitions of carrying capacity given by various scholars and organizations are: carrying capacity is the maximum number of visitors who can visit an area without leading to severe environmental degradation or serious decline in the quality of the experience gained by visitors (Aylward *et al.*, 1996, Mandziuk, 1995).

From an ecological perspective, carrying capacity is understood as the maximum number of individuals of a given species that a given habitat can support, without being permanently damaged (Odum, 1989). The World Tourism Organization (WTO, 1993), however, proposed a definition of carrying capacity for tourism as "the maximum number of people that may visit a tourist destination at the same time, without destroying the physical, economic, socio-cultural environment, and an unacceptable decrease in the quality of visitors' satisfaction".

For Buckley (1999), the concept describes the number of visitors that produces no detectable, or at least no irreversible, ecological change to the ecosystems in an area. On the

other hand, carrying capacity refers to a certain threshold of people's activity beyond which damage to the environment will occur (Williams & Lemckert, 2007). The concept is thus dynamic and fluid, neither fixed nor static, and can depend on the speed of change (Simon et al., 2004).

Mathieson and Wall (1982) defined carrying capacity as the maximum number of people who can use a recreational environment without an unacceptable decline in the quality of recreational experience. According to Saveriades (2000), the carrying capacity of a destination is determined (i) by its ability to absorb tourist development before negative impacts are felt by the host community, and (ii) by the level of tourist beyond which tourist flows will decline because the destination area ceases to satisfy and attract them.

According to the National Institute of Urban Affairs (1997), the notion of carrying capacity refers intrinsically to the finite capacity or limitation of the natural environment both as a reservoir to support human consumption and a sink to assimilate the residuals or wastes.

According to Sharma (2016), ranking of relevant indicators and relative importance index for each indicator under each environmental component provides the crucial first tier platform for assessing the total carrying capacity. The indicators of tourism carrying capacity relevant for this study were identified through different tourism, environment and tourism management journals. Literature and studies conducted in the area linked to tourism and impact assessments were also taken into account to draw indicators relevant to the area.

The recent attempts to develop actual carrying capacities in terms of specific numbers of tourists or visitors raise significant questions for the decision-makers that establish policy strategies for tourism development (Saveriades, 2000). The aim of estimating tourism carrying capacity is thus to determine the upper desirable limits of development, i.e. the optimal use of tourism resources. But it also means making decisions about what ought to be done, what recreational opportunities should be provided, and how recreation use should be managed. Several methods enable the evaluation of the number of visitors to a PA such as Tourism Carrying Capacity (Cifuentes, 1992), which takes into account three levels of analysis: Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC) and Effective Carrying Capacity (ECC), where PCC > RCC > ECC. Other methods include Limits on Acceptable Changes (Stankey et al., 1985), Visitor Experience and Resource Protection (US Department of the Interior, 1997), Tourism Optimization Management Model (Manidis

Roberts Consultants 1997), and Visitor Impact Management (Kuss et al., 1990). Thus, it is important to evaluate the carrying capacity of PAs to ensure that they can handle levels of visitation, which enable them to become economically self-sustainable (Cifuentes, 1992; Boo, 1993).

Pereira da Silva (2002) suggests that development objectives are determinant in the calculation of carrying capacity and can help manage the inevitable negative impacts from leisure activities; whilst Munar (2005) outlined that the carrying capacity provides the optimum level upon which resources can deteriorate or damage to the ecosystems are irreversible, providing a mathematical formula of how many tourists are enough. Coccossis and Mexa (2004), indicated that despite several criticisms, carrying capacity assessment remains a powerful concept that can be used for planning and management of sustainable tourism; Segrado *et al.*, (2008) reported that apart from outlining all factors that limit tourism growth, the concept of carrying capacity also indicates compensatory tools to manage tourism flows to a destination; whilst Bonilla and Bonilla (2009) indicated that this concept should be seen as a positive and dynamic prism contemplating the temporal space as a basic value for the implementation of sustainable beach management principles.

A similar method of TCC calculation has been followed by various authors viz. Cifuentes (1992), Maldonado and Montagnini (2005), Lone *et al.* (2013) and Queiroz *et al.* (2014). Green 1995, has also developed a model that introduces the idea of environmental limits or carrying capacity to tourists' number, beyond which development at destination areas becomes unsustainable. In the absence of strict guidelines for states and protected area managers, for restricting the number of visitors, and to develop a comprehensive ecotourism plan, there is very little evidence that ecotourism in its present form is sustainable (Ramavarapu 2017). Lagmoj *et al.* (2013) have also demonstrated that tourism carrying capacity (TCC), Tourism Carrying Capacity can be evaluated in three ways, Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC) and Effective Carrying Capacity (ECC). Although there was a significant difference between the physico-ecological and socio-cultural carrying capacity a study by Zacarias *et al.*, (2011) suggests that the physico-ecological carrying may be applied for ecosystem management, whilst the socio-cultural carrying capacity may be addressed when management objectives are tourists.

Nghi *et al.* (2007) observed that in Quang Bind province particularly Nha-ke Bangphon national park in Vietnam, a lot of annual tourists are entering this area , due to

ignorance on environmental practices, they destroyed the environment as the result of unwanted activities. This has created environmental and social concerns. On this basis, researchers concluded that by estimating the carrying capacity of this area, a systematic, suitable plan will be developed to prevent the adverse effects of the excessive presence of tourists. They have achieved tourism carrying capacity based on three indicators including ecologic, economic and social processes. Results of this study indicated that people perform their greatest tourism activity as touring and walking during the day. Also, it was found that an average of 71,000 persons daily visit this park which is much more than the acceptable carrying capacity of the region.

Lagmoj *et al.* (2013) studied the effect of economic indicator limit to evaluate the tourism carrying capacity for ecotourism purpose. This study aimed to present the carrying capacity limits based on the quantitative description in tourism economic modelling. In this study, it was identified that according to the effects of tourism activities on the full time tourism carrying capacity, increased growth in the tourism demand is noted. This will decrease the temporal speed of tourism currents particularly in the crowded seasons of the year. They also evaluated the carrying capacity of the area for using the sustainable land use plan. In this study, a wide range of methodological strategies to evaluate the carrying capacity was recognized, compared and studied. Also, in the study, a wide range of key measures were used to compare the various factors of carrying capacity evaluation model including; uniform analysis system, dynamic response, risk taking levels, systemic limitations, applying for future planning and taking into consideration the area boundaries. By combining and collecting these factors, a wide range of connected data of the model was achieved based on practical Systems which are applicable in the future.

To determine the sustainability of coastal ecotourism management by calculating the effective number of tourists who can be accepted in Baluran National Park, Indonesia, the concept of tourism carrying capacity, consisting of the ecological environment, economic, social and physical carrying capacity was used. The results of the combined carrying capacity analysis showed that 3,288 people per day (151,248 tourists per year) is the maximum number of accepted tourists. The current number of tourist arrivals is only 241 people per day (87,990 tourists per year) which is far below the carrying capacity. The condition shows the high possibility to increase the number of tourists (Armono *et al.*, 2017).

In sustainable ecotourism, the carrying capacity limits the number of tourists that can visit without negative cultural or environmental impact. This limit can be either an environmental, structural, or socio-cultural induced limit. When the carrying capacity of a tourism location is exceeded, it can result in various negative consequences. These consequences can include but are not limited to: soil erosion, forest degradation, loss of biodiversity, waterway pollution, environmental degradation due to garbage and litter, and an overburdening of infrastructure and sanitation systems. Ideal sustainable tourism continually evaluates the carrying capacity of a location to ensure that it is not exceeded (Wood, 2002).

From the literature, it can be concluded that with an overall positive impact of ecotourism activities, some negative impacts are also associated with this service. To quantify the positive or negative impact that an ecotourism site has on its environment, concepts like carrying capacity and sustainability indicators in a region need to be identified for ensuring its sustainability.

Sabokkhiz *et al.* (2016) have ascertained that carrying capacity can have different partial definitions, especially depending on the economic, social and environmental dimensions and this analysis can be a big contribution in preventing biological damages to the environment. And to determine the number of visitors, the average usage of ecotourism sites are surveyed in physical, real and effective levels.

As per the findings of a case study by Ramchurjee and Suresha (2014), it was seen that tourists have positive environmental behaviours and environmental beliefs at the ecotourism spots, showing concerns for conserving and preserving the environment. They have high levels of understanding of the impacts of ecotourism on the destination sites and their surrounding environment.

According to Weaver (2007), ecotourism is defined as a form of tourism that fosters learning experiences and appreciation of the natural environment, or some component thereof, within its associated cultural context. It is managed in accordance with industry best practices to attain environmentally and socio-culturally sustainable outcomes as well as financial viability.

According to Tran and Anh (2011), ecotourism affects the environment of destination places in various ways. All the activities are related to nature and utilize natural resources to

accomplish the recreation. The impact of the use of natural resources occurs rapidly and the recovery of the resources occurs more slowly. Therefore, sustainable management is very important to be carried out to prevent damage to nature due to hiking and camping.

According to Rangaswamy (2012), the scientific community, tourism industry, development field, tourists who visit natural places and local populations impacted by ecotourism must continually be educated and informed about ways to promote successful ecotourism policies and practices. Important social, economic, and environmental imperatives must be considered for ecotourism to meet its potential to promote sustainable development and benefit local communities.

According to Dowling and Fennel (2003), there are four main dimensions to be environmental maintenance of a successful ecotourism program: it must have a strong nature base, support for conservation in the area, sustainable management practices, and an element of environmental education for locals and tourists. Support for conservation and sustainable management is especially important to ecotourism destinations because they are "usually concentrated in sensitive and unique environments" Diamantis (2004).

According to a study conducted by Nyaupane and Thapa (2004), a comparative evaluation of the perceptions of environmental, economic and socio-cultural impacts between residents of a traditional tourism area and a recently created ecotourism area was made. It was concluded that residents of the ecotourism area perceived fewer negative as well as positive impacts (environmental, economic, and socio-cultural) as a result of tourism than the residents of the traditional tourism area.

A study conducted in Costa Rica's Osa Peninsula Hunt *et al.* (2014), tested the hypothesis that ecotourism in this region was more effective at improving well-being of residents, enhancing their access to key resources and information, and supporting biodiversity conservation than other locally available economic sectors.

The concept of tourism carrying capacity arises from the perception that tourism cannot grow continuously in a particular region without causing irreversible damage to the locals. The concept of carrying capacity in tourism has its origin in the 1960s when it was developed to place limits on the numbers of visitors that a tourist attraction could cope up with (Coccossis and Mexa, 2004)

According to Saveriades (2000), the carrying capacity of a destination is determined (i) by its ability to absorb tourist development before negative impacts are felt by the host community, and (ii) by the level of tourist beyond which tourist flows will decline because the destination area ceases to satisfy and attract them.

Sharma (2018) predicted that on average with the current rate of increase in tourist inflow in Himachal Pradesh, the carrying capacity of the ecotourism sites will be exhausted in the next 12-15 years if no managerial changes are made in handling the ecotourism sites. Also, there is a need to adopt greener energy sources.

According to a study by Vnasiya and Mahida (2012), ecotourism has been proposed as a viable economic activity that can minimize negative human impacts on wildlife habitat and provide an incentive to preserve natural areas. Ecotourism is a proxy market designed to align consumers' preferences for recreation along with the protection of environmental assets.

According to Nag (2013) an inadequate ecotourism management plan can cause negative impacts on community and decreased eco-tourist's and stakeholder's environmental awareness causes severe environmental degradation that indirectly leads to natural habitat destruction. Ecotourism should be therefore developed properly by understanding few factors such as sustainability indicators and carrying capacity.

2.3 ECOTOURISM SITES IDENTIFICATION

Holden (2003) acknowledged that the ecotourism resource in protected areas could generate more revenues, which could benefit the local people and contribute to the conservation of protected areas. The main natural ecotourism potential attractions are the lakes, forests, mountains, birds and as well as wild mammals, which can attract tourists and may contribute to the conservation of natural and improves the livelihoods of the local community.

Chang *et al.* (2008) concluded in a study that GIS is an essential tool for natural resources management because the maps as stored or filed as information layers in GIS which makes complex analysis possible to perform. GIS can link and integrate various kinds of data as well as it also combines mapped variables to build and analyze new variables (Eddie *et al*. 2007).

Bhaya and Chakrabarty (2016) identified potential ecotourism sites in Jungle Mahal, West Bengal using Remote Sensing and GIS techniques in forest dominated areas. According to them, the GIS approach of visualization is an innovative discipline to recognize the 'Ecotourism' potential of an area by assessment and integration of spatial and non-spatial data. They also acknowledged that after identifying the potential sites, a demonstrative plan has to be made for ecotourism development based on locally available natural resources. Buckeye Obadiah James in their study observed in Uganda's National Park for eco-tourism development, found that ecotourism has opened new employment opportunities along with equivalent expansion in other sectors of the economy.

Banerjee *et al.* (2006) in the case study for western Medinipur, West Bengal, India, to identify the eco-tourism potential zone and discussed various aspects of ecotourism planning along with a demonstrative plan for eco-tourism development base on the locally available natural source. They considered that ecotourism is important for environmental conservation and economic development. Their view to conserve and maintain the biological richness of the areas as well as economic up-liftmen of the local people by providing employment and opportunities in the field of eco-tourism development.

Samanta and Baitalik (2015) emphasized that there is a strong need to study ecotourism, as part of an alternative form of tourism for the growth of low impact tourism in the area and its natural ecosystem maintenance as well as for the benefit of the local population. The authors to identify potentially suitable sites for ecotourism in the surroundings of Bankura, West Bengal based on the Natural components of ecotourism considered factor namely: land use-land cover, soil, elevation, slope, vegetation map, road net-work map, drainage map, temperature and rainfall to determine the suitability of the area for ecotourism. Eco-tourism development is visualized as a development tool–not just in promoting tourism growth but also in reducing poverty, particularly in rural areas. Economic pursuits in those areas are limited to agriculture, live stock and transboundary trade. All these activities suffer from low productivity and are subsistence oriented. Ecotourism is expected to engage them in the higher productivity areas by linking to commercial process, and marketing chain extending beyond borders.

According to Asmamaw and Gidley, (2018) multi-criteria evaluations such as land use land cover, soil, slope, elevation, scenic attractiveness, rainfall and temperature are useful for GIS based ecotourism potential areas as used for identification of ecotourism area in

Hugumburda Forest in Ethiopia. These important factors help to determine what areas are best suited for ecotourism development.

Dev (2005) studied the relationship between demographic characters and preference of ecotourism activities among Indian eco-tourists, and established the relationship between them, it was revealed in the study that preference of ecotourism activities of Indian eco-tourists is almost the same, irrespective of their age. Tourism was viewed as a 'clean' industry during the twentieth century that could generate capital (Hanna *et al.* 2015), later on, mass tourism became a concern for environmental sustainability. The concept of sustainability in tourism emerged which is ascribed as a remedy for problems of contemporary tourism (Butowski, 2012) to obtain an optimum benefit for present without influencing the need and demand of the future. Sustainable tourism can become a useful tool to generate employment, combat poverty and simultaneously protect biological diversity and cultural environment involving local communities (UNEP, 2005).

Suryabhagavan *et al.* (2015) in order to evaluate and identified the ecotourism potential of the area using multi-criteria techniques for optimal exploitation of the area for ecotourism gives optimum results. Integrated approaches of multi-criteria techniques were used by them to generate maps of visibility, land-use/land-cover, slope, elevation, proximity to the lake, natural and cultural attraction sites, fauna and flora conservation, rainfall, temperature and proximity to the road.

Remote sensing and GIS have been used for the identification of potential eco-tourism sites based on various environmental indicators i.e., ecological fragility, environmental resilience and eco-tourism attractively (Arrowsmith and Inbakaran, 2002). The role of remote sensing has been emphasized in the appraisal of the habitat attributes, identification of new sites for protected areas and the current status of wildlife corridors in many areas (Kumari *et al*., 2010). Remote sensing not only provides a spatial data but also allows the comparison of the temporal variations in the habitat features (Lillesand and Kiefer, 2004). Arrowsmith, (2001) has also considered remote sensing and GIS based tourism attractively index, accessibility and environmental resilience for identification of the potential tourism sites in Gramphian National Park, Australia.

Mohd and Ujang (2016) emphasised the use of Multi Criteria Decision Analysis (MCDA) a spatial decision process that mostly involves a large set of feasible alternatives

and multiple criteria evaluation. Usually, most researchers make decision process by using GIS that recognized as a decision support system which can analyze, design, evaluate and prioritize alternative decisions to ecotourism development. GIS also can obtain the information for decision making through a transformation process and combines the geographical data and the value judgments. MCDA provides a variety of collections with an efficient technique and structuring procedure to get a decision. Thus, decision making involves multi-criteria evaluation (MCE) used to rank and achieve the priorities for the alternatives of a decision.

Multiple criteria evaluation is commonly related to and uses the Analytic Hierarchy Process (AHP) this is an important technique to analyse land suitability developed by Thomas L. Saaty and it is a measurement theory through pairwise comparisons in deciding between alternatives and criteria needed to earn the scale of priorities. So, before AHP is implemented, all relevant criteria like slope, temperature, climate and soil types should be identified and studied first. Multiple criteria evaluation is very significant for making a decision that can be used in any method in involving GIS tool. The criteria of evaluation need to be standardized and weighted to achieve the best location for ecotourism and have been successfully applied by many researchers.

A criterion/factor needs to be evaluated and measured for decision making Baba *et al.* (2015) commented that criteria like slope and aspect are significant for ecotourism development and could not be neglected. Selecting or formulating the criteria is very important for decision makers can then choose several methods to determine the weight of each factor such as by ranking, rating and Analytic Hierarchy Process. A review represented Buruamkaew and Muruyam (2011) in Thailand, indicated that the steep areas with a slope more than >45% is a limiting factor for ecotourism activities. They conclude slope with >15% could be appropriate criteria. According to Geremew and Hailemeriam (2015) in Ethiopia, mostly ecotourism take place in historical resources, natural area and traditional culture. Thus, the criteria of road distance must be considered about the natural area. Another research result by Kumari *et al.* (2010) in Malaysia suggested that ecotourism activities are influenced by climatic condition. So, the climate factor must be investigated to obtain the suitable ecotourism land.

The role of remote sensing has been emphasized in quick appraisal of the habitat attributes, identification of new sites for protected areas and the current status of corridors.

Kushwaha *et al.* (2004) in a study has tried to develop an integrated approach of ecotourism development by identification of ecotourism sites. Use of ecotourism indicators helps in identifying the potential ecotourism sites based on the environmental parameters. This can also have its implication at the site level environmental management of ecotourism activity based on ecotourism principles, ecological fragility and environmental resilience. The authors tried to develop ecotourism indicators for identification of potential ecotourism sites in geospatial environment. The present study provides scope for future studies using ecotourism indicators for identification of potential ecotourism sites in other ecosystems. It may also include other environmental parameters like environmental vulnerability index and environmental disturbances index to make it applicable in other conditions as well (Kumari *et al.,* 2010).

Ambecha *et al.* (2020), in a study to identify potential ecotourism sites using Geographic Information System (GIS) and Multi-criteria Decision Analysis (MCDA) in Adiracha district of Sheka Zone, south-western Ethiopia used remote sensing data. Landsat ETM Image and STRM data of 2016 with 30 m resolution and topographic map of Ethiopia were used. Ecotourism potential site selection criteria were designed based on stakeholder's opinions. The final suitability map of ecotourism was realized by applying an integrated weighted overlay technique of GIS. The suitability map was categorized into four classes as suitable, moderately suitable, less suitable, and not suitable, and an attempt was made to indicate the level of ecotourism suitability at a different location in the study area.

Masoum *et al.* (2012) lead a study for the development of ecotourism in partnership with local communities and conservation projects that can restore local livelihoods. They emphasised that through ecotourism villagers can learn how to manage the wildlife and landscapes in a sustainable manner making sound livelihood decisions without sacrificing their cultural values. The authors determined the potential in Marvdasht County for ecotourism planning in and the surrounding rural areas. They found that the use of integrated MCDM-GIS approach effectively assists ecotourism planning.

MCDM is a tool for ecotourism planning since it takes into consideration the different criteria that have a significant impact on the decision. The application of MCDM can be successfully used to divide the study area into different conservation levels by considering various factors and constraints. They concluded that the proposed method can

be used for ecotourism planning, policy and decision making to approach ecotourism development issues with a deeper understanding of environmental factors.

2.4 STRATEGIC DEVELOPMENT OF ECOTOURISM

It is crucial to view ecotourism in its true dimensions, so as neither to exaggerate its potential benefits nor to underestimate its potential risks. After all, the development of ecotourism, like all other forms of tourism, also requires careful planning and constant monitoring to lead to the desirable results (Anonymous, 2001).

There is a strong need to study ecotourism, to develop it as part of an alternative form of tourism for the growth of low impact tourism in the area and its natural ecosystem maintenance as well as for the benefit of local population (Samanta and Baitalik, 2015).

According to Wang *et al.* (2014) ecological and environmental protection is the core content of ecotourism development. A quantitative evaluation of the effects of ecotourism environmental protection measures on protected areas is conducive to a deeper understanding of the key issues related to ecotourism development in any region, thus providing a theoretical basis for formulating the relevant national policies of sustainable ecotourism development there.

Rana and Pandey (2016) conducted a study using geospatial techniques in ecotourism development and indicated that primary data regarding the social and cultural activities, infrastructure availability etc. generated by discussions, onsite observations and questionnaire could be utilized for tourism planning and checking the sustainability of the site. Bhaya and Chakrabarty (2016) after identifying the potential sites, made a demonstrative plan for Ecotourism development based on locally available natural resources.

Kreiner and Wall (2007) applied SWOT analysis in the Western Negev tourism area of Israel, the findings relate to both the use of the SWOT technique as a research method and an evaluation concerning the tourism potential of an area, and that this analysis can assist local decision makers by estimating the potential benefits and threats to tourism development.

According to Mousavi *et al.* (2012) SWOT can be used as a basis for the analysis of ecotourism development along with social and cultural impacts. SWOT analysis is a valuable step in situational analysis of a developing country. Assessing a developing industry's

strengths, weaknesses, market opportunities, and threats through a SWOT analysis is a very simple process that can offer powerful insight into the potential and critical issues affecting a venture.

Sayyed *et al.* (2013) used SWOT in order to identify the required management strategies to improve sustainable tourism in the Tandooreh National Park. SWOT analysis has shown that well-established tourism destinations with a variety of natural attractions and unique cultures of local people are the strengths, while lack of infrastructures and fundamental facilities are the major weaknesses.

According to Peroff *et al*. (2017) rural tourism partnerships could be better positioned for success in ecotourism by paying particular attention to two important lessons: (a) ensuring their partnership crafts meaningful, effective, and enduring processes; and (b) fostering a sense of responsibility and commitment.

As documented by Bramwell and Sharman (2001); Castro and Nielsen (2001) the sharing of ideas among different stakeholders in a long time period can result in a deeper understanding of the issues, and should result in more legitimate and sustainable policies for ecotourism development in an area.

Yadav (2010) emphasized the importance of ecotourism for long-term conservation and bio-diversity. It was suggested in the study that in most protected areas, ecotourism remained an unrealized possibility and the links between ecotourism development and conservation were poorly understood. Ecotourism developments were often limited by a narrow focus on infrastructure development and failed to maximize opportunities for generating local benefits.

In order to ensure the sustainable development of rural eco-tourism, it is necessary to analyze its planning in many aspects (Shang *et al.* 2020). The development of policy and planning on ecotourism in potential areas, where certain parties or stakeholders should integrate the concept of sustainability in planning to make sure the industry will continue to survive for decades. Failure to do so will not only give an impact on the environment but also make the ecotourism industry will not last long. Besides, sustainable guidelines generated in this study can help to improve the practice among ecotourism agencies where it will be more sustainable and environmentally (Jaini *et al.,* 2019).

Ghorbani *et al.* (2015) evaluated the current situation of ecotourism in Kaji Namakzar Wetland, South Khorasan Province, Iran, using SWOT (superiority, weakness, opportunity and threats) and the quantitative strategic planning matrix and provided sustainable development counter measures. Demir (2016) investigated Igneada, Turkey, using field observation, SWOT and analytic hierarchy process, defined a set of criteria for eco-tourism and put forward ecotourism prospects for the region. Kronenberg (2016) discussed Polish bird-watching tourism with SWOT analysis and put forward suggestions on sustainable management of ecotourism and enhancing the attractiveness of the region.

According to Shang *et al.* (2020), SWOT method can be used to analyze an objective from many angles, so it can be applied for the analysis of ecotourism. This method can be adopted to analyze ecotourism and used to make targeted suggestions according to the analysis results. The conclusion was that the superiorities of Tianjin rural ecotourism were larger than the weakness and the threats and opportunities were equal, i.e. Tianjin rural ecotourism showed a state of sustainable development. Ecotourism is seen as a tool for conservation and sustainable development (Yilmaza *et al.,* 2013).

SWOT (Strength – Weakness – Opportunity – Threat) analysis surveying internal and external environment is an important part of strategic planning. Internal factors can be classified as strengths (S) and weaknesses (W) whereas external factors can be classified as opportunities (O) and threats (T). SWOT analysis helps in analyzing the advantages and disadvantages of ecotourism and coming out with strategic suggestions for ecotourism planning and development. This also helps in the understanding of elements, processes and practices of local institutions to determine appropriate interventions for nearby ecotourism activities. Following that, strategic alternatives are selected in the light of the strengths, weaknesses, threats and opportunities as determined through internal and external environment analysis (Yuksel and Dagdeviren, 2007). According to Saaty (1987), SWOT analysis is intended to plan a strategy to maximize strengths and opportunities; minimize external threats and transform weaknesses into strengths to take advantage of opportunities along with minimizing both internal weaknesses and external threats.

Although SWOT analysis research method is often used in business fields it has now been extended to natural resource management to assess the decision and policy directive in a systematic manner (Schmoldt *et al.* 2001) and also in the assessment of sustainable tourism (NOAA, 2011). The strengths and weaknesses (local analysis) are the internal factors while

opportunities and threats (global analysis) are external factors (Harfst *et al.* 2010). Evaluation of internal and external environmental factors is an important part of strategic planning which is instrumental in adopting the strategies and becomes a component of sustainable ecotourism management.

The fast growing tourism industry is also a major source of pressure on the environment and natural resources (UNEP 2005). This is especially true for developing countries where tourism development is taking place rapidly in ecologically fragile areas with modest concerns about the environment (Aminu *et al.* 2013). World Tourism Organization (WTO) defines sustainable tourism as tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, industry, environment and host communities (UNWTO, 2017). This is not a type of tourism instead a condition of tourism that is based on the principles of sustainable development (UNEP and UNWTO, 2005). This concept has gradually become an important determinant of tourism development, nevertheless, it is considered more important for destinations that depend on nature as their major tourist attraction (Larson and Herr, 2008). Sustainable tourism approach may offer a higher quality tourist satisfaction, improved life quality for local citizens, conservation of environment, and enhancement of cultural pride, but it needs to be planned scientifically taking into consideration all the components related to environment, economy and socio-cultural components, a technique considering a technique like SWOT (Ap and Crompton 1998; Higgins Desbiolles 2004 and Levy and Hawkins 2009).

Ecotourism development involves the integration of many factors including tourists, residents and managers. Ecotourism is seen as a tool for conservation and sustainable development, so maintaining sustainable development for an ecotourism site has become a critical issue. Gurung and Seeland (2008) have analysed tourism in Bhutan and also considered the prospects for the developments of ecotourism. In a research on the economic development and resource protection concepts and practices in sustainable ecotourism carried out by Libosada (2009), it has been concluded that an often-debated issue in ecotourism is the concept of carrying capacity which establishes the maximum number of people or tourism development in any given space at a given time.

Lai and Nepal (2006) have examined the local responses to potential ecotourism development in the Tawushon Nature Reserve located in south-eastern Taiwan including measurement of community attitude and intention towards four dimensions of ecotourism,

including conservation of natural resources, preservation of cultural tradition, sustainable community development, and participation in ecotourism planning and management introducing researches related to the strengths-weaknesses, opportunities-threats are also carried out intensely. When eco-tourism is planned well, it provides benefits for providing the sustainability of natural and cultural resources and bringing environmental, economic and social concerns together (Yilmaza, 2013).

SWOT analysis is a structured planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a project or a business venture. A SWOT analysis can be carried out for a product, place, industry or person. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve that objective. The Travel and Tourism Competitiveness Report ranks India 34th out of 141 countries overall as of 5th May 2020. Unregulated infrastructure development for tourism can lead to ecological and environmental imbalances. Disposal of waste, forest destruction, depletion of water level, pollution caused by vehicles can be threatening for the environment. The ecotourism market is at risk from extreme weather events like floods, rain and scorching summers (Agrawal, 2016).

SWOT analysis is an important technique of environmental analysis; many authors have used the profile of environmental threat and opportunity (ETOP), while others have used the strength, weakness, opportunity, and threat (SWOT) as a technique of diagnosing the environment. By ETOP and SWOT, we can observe the impact of each environmental sector like economic, political and social on the industry (Bhatia, 2013). Every destination has some internal strengths and weaknesses that either enhance its capacity to attract foreign visitors or diminish it. Similarly, opportunities or threats can originate from the external environment.

SWOT is an acronym for the internal strength and weaknesses of a business and environmental opportunities and threats faced by any business. It is a systematic identification of the factors and strategy that reflects the best match between them. The logic behind this technique is that an effective strategy maximizes business strength and opportunities on one hand and minimizes its weaknesses on the other (Bhatia, 2013).

A SWOT (Strength, Weakness, Opportunities and threats) analysis is also known as SWOT matrix in advance research to analyse some key factors of particular activity involving business/natural resources management, etc., (Schmoldt, Kangas, Mendoza, and

Pesonen, 2001). SWOT is a kind of strategic developmental planning (Buta, 2007) gaining popularity in the fields of sustainable resources management (NOAA, 2011). This method is constructed on two different factors which encompass the SWOT analysis: Firstly, internal factors are introduced to analyse the issues of strengths and weaknesses and secondly, the external factors are introduced to explain the opportunities and threats. Scanning the internal and external factors is an important part of a strategic development planning process which is turned into a component analysis for sustainable livelihood and environmental development (Reihanian *et al.* 2012).

The development of ecotourism requires extensive research and planning because without a proper strategy, the benefit from this industry cannot be equally distributed among the related stakeholders. Therefore, it is essential to develop sustainable ecotourism to resolve social and economic problems of the country. Considering the above requirement it is necessary to examine different strategic factors of the ecotourism industry using a sophisticated tool such as SWOT analysis. SWOT analysis is a crucial tool for decision-making (Wheelen and Hunger, 1995), it involves the systematic assessment of ecotourism, its internal strengths and weaknesses, opportunities for growth and improvement and the threats that the external environment presents to its sustenance (Harrison, 2010). SWOT analysis is a useful tool as an initial step before the detailed development of sustainable ecotourism in any region.

SWOT analysis generally investigates the strengths and weaknesses inside the system, as well as the opportunities and threats from the external environment to facilitate the decision-makers find out the best strategy, thus to maximize the strengths of the system itself and minimize the weaknesses of the system and threats from outside (Wang and Zheng 2015). According to them SWOT is an effective tool to facilitate the decision makers find out the best strategy, thus to maximize the internal strengths of the system itself and minimize the weaknesses and to grab opportunities and combat threats from outside.

A visitor satisfaction survey in Dharamshala, a major tourist destination in Himachal Pradesh, revealed that hygiene, waste, lack of safe drinking water, poor transport and communication were amongst some of the aspects of the town that were rated very negatively (Singh and Hietala, 2014).

Four different categories of strategies can be considered in the SWOT matrix namely SO - strategies: internal strength(s) can be used to realize external opportunity (ies); WO-strategies: reduce internal weakness (es) or develop missing strength(s) to realize external opportunities; ST-strategies: internal strength(s) are used to minimize external threats and WT-strategies: reduce the internal weakness (es) to avoid external threats (Rauch 2007 and Tahernejad *et al.* 2013).

A SWOT matrix is a structured planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a project or a business venture and can be carried out for a product, place, industry or person, it involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve that objective (Agrawal, 2016).

SWOT analysis helps in analyzing the advantages and disadvantages of the ecotourism activities and helps to come out with strategic suggestions for its planning. It also helps in a sound understanding of elements, processes and practices of local institutions in order to determine appropriate interventions for ecotourism development. Following that, strategic alternatives are selected in the light of the strengths, weaknesses, threats and opportunities as determined through internal and external environment analysis of the industry (Yuksel and Dagdeviren, 2007). SWOT analysis is intended to maximize strengths and opportunities, minimize external threats; transform weaknesses into strengths and take advantage of opportunities along with minimizing both internal weaknesses and external threats of any industry (Saaty, 1987).

Since the inception of the concept of ecotourism as an approach for sustainable tourism, many authors have emphasised on the assessment of this new venture in different ways. Sustainability assessment being the most important as evident from the guidebook published by the UNWTO, on indicators for sustainable tourism development. Furthermore, the site should not accommodate visitors more than its effective carrying capacity, so the carrying capacity assessment of the sites is crucial to ensure not much pressure is put on the surrounding resources. For the overall socio-ecological development of the mountain communities and conservation of environment ecotourism industry needs to be strengthened in addition to the proper strategic planning for its setup and development.

Chapter-3

MATERIALS AND METHODS

Present investigation entitled **"Sustainability Assessment and Identification of Ecotourism Sites in Himachal Pradesh"** was conducted during 2018-2020. The study consists of assessment of existing ecotourism sites for sustainability with the help of selected indicators, carrying capacity, identification of additional potential ecotourism sites for further expansion and SWOT analysis for sustainable strategic development of the industry. Details of study area, materials used and methods employed during the study are presented in this chapter.

3.1 DESCRIPTION OF STUDY AREA:

The state of Himachal Pradesh has a total area of 55,673 km^2 and lies between 30°22'40"N and 33°12'40"N latitudes and 75°45'55"E and 79°04'20"E longitude with a population of 68.56 lakh as per 2011 census, and further projected to be 73.82 lakh during 2019-2020. It is endowed with a myriad of climate niches comprising snow capped mountain ranges, hills and valleys exhibiting an altitudinal variation from 350m to about more than 6975m above mean sea level. The physiography of the area is marked by an undulating topography dotted by elevations and depressions. The drainage system of Himachal is composed of rivers, springs, streams, rivulets and glaciers. Himalayan rivers criss-cross the entire mountain chain in Himachal Pradesh that provides water to both the Indus and Ganges river basins. The drainage system of the region includes the Chandra Bhaga or the Chenab, the Ravi, the Beas, the Sutlej, and the Yamuna. These perennial rivers are fed by snow and rainfall in addition to a number of seasonal water sources including waterfalls. They are protected by an extensive cover of natural vegetation. The state has gentle to steep slopes ranging from three to more than 50 per cent marked with few steep gorges formed by cutting action of small streams and rivulets. Nestled in the Western Himalayas, the state of Himachal Pradesh is one of the most popular and easily accessible hill state of the country offering unlimited opportunities to enjoy nature in its most pristine state. Being a mountainous state comprising of an intricate mosaic of mountain ranges, hills and valleys it offers great opportunities for ecotourism and the state has become a destination for all seasons and reasons. The region provides a congenial habitat to a wide variety of Himalayan flora and fauna and conjures up visions of ancient temples, occupying almost

every hilltop and the festivities associated with these religious places. Himachal Pradesh is famous for its towering hills, enchanting valleys, beautiful landscapes and popular hill stations. Many outdoor activities such as rock climbing, mountain biking, paragliding, trekking rafting, ice skating and heli-skiing are popular tourist attractions in Himachal Pradesh (Economic Survey, 2021). People from all over India and abroad visit this beautiful state to enjoy its natural beauty. The data of 22 years (Appendix I) shows that 25.02 Cr. tourists have visited the state with a CAGR of 8.39% that implies a positive trend in the inflow of both Indian and Foreign tourists as depicted in Fig. 3.1.

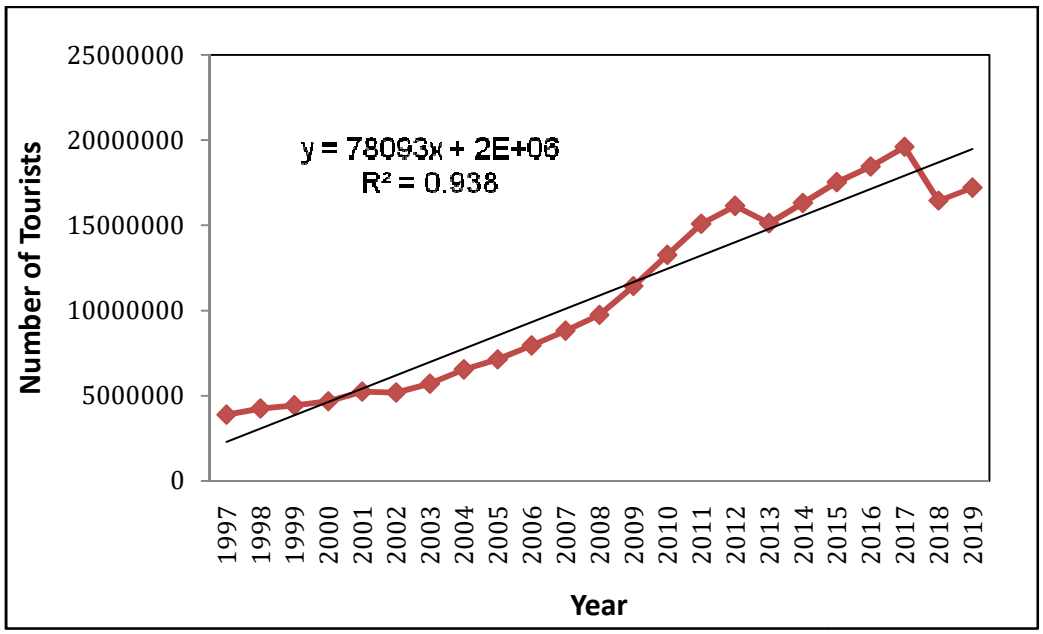


Fig. 3.1: Tourist influx trend in Himachal Pradesh

3.1.1 Climatic and Weather Conditions

The climate of state varies with the altitude and agro-climatically it has been divided into four zones. Due to extreme variation in elevation, the state of Himachal Pradesh experience varied climatic conditions. The climate varies from hot and sub-humid tropical in the southern tracts and with increase in elevation, cold, alpine, and glacial in the northern and eastern mountain ranges. The annual rainfall in the state ranges between 1100 to 2500 mm, the bulk of which is received during monsoon months (June-September) with few pre-monsoon showers. Dharamshala, the state's winter capital receives very heavy rainfall, while areas like Lahaul-Spiti are cold, almost rainless and commonly experience snowfall. The state of Himachal experiences three seasons: summer, winter, and rainy season. The climate type of Himachal Pradesh is sub-tropical temperate and there is a considerable variation in the

seasonal and diurnal temperature. The mean minimum and maximum temperature vary from -2 to 15^0C in winter and 25 to 38^0C in summer months. Summer lasts from mid-April till the end of June and most parts become hot (except in the alpine zone which experiences a mild summer). Winter season fall from late November till mid-March. In general, May and June are the hottest months whereas; December and January are the coldest ones in the region.

3.2 EXPERIMENTAL DETAILS

In Himachal Pradesh a number of ecotourism sites identified by the State Forest Department are running on two modes i.e. Public Private Partnership (PPP) and Departmental. The PPP sites are leased out by the State Forest Department to the individual firms on the terms and conditions mentioned in the Ecotourism Policy of the state, whereas the State Forest Department completely controls the activities on the department mode sites. List of ecotourism sites active at the time of initiation of the study was collected from the Ecotourism wing of the State Forest Department. Eight ecotourism sites functioning in three districts of the state under PPP mode were selected for study; similarly, out of the 16 ecotourism sites running on Departmental mode in six districts of Himachal Pradesh, eight were selected for assessment as per the details vide table Table 3.1 and Table 3.2, respectively.

Table 3.1: Spatial distribution of PPP ecotourism sites in Himachal Pradesh

Name of the ecotourism site	Place	District	Location
Aamod	Shoghi	Solan	31.030744°N, 77.102918°E
Nature's Treat	Khalogra	Solan	30.890653°N, 77.088918°E
Park Woods	Aanji	Solan	31.033174°N, 77.090458°E
Pine Hills Eco-Camp	Chewa	Solan	30.905736°N, 77.057619°E
Nature Camp	Sanawar	Solan	30.907565°N, 77.004186°E
Aamod, Ala	Dalhousie	Chamba	32.529867°N, 76.004289°E
Nature Camp	Narkanda	Shimla	31.257772°N, 77.460158°E
Himalayan Nature Camp	Jalodi	Shimla	31.537079°N, 77.084606°E

Table 3.2: Spatial distribution of Department ecotourism sites in Himachal Pradesh

Name of the ecotourism site	Place	District	Location
Ecotourism site	Kasol	Kullu	32.011206°N, 77.312965°E
Ecotourism site	Devidarh	Mandi	31.475000°N, 77.122027°E
Ecotourism site	Parashar	Mandi	31.757582°N, 77.092821°E
Children Park	Hamirpur	Hamirpur	31.703438°N, 76.524280°E
Ecotourism site	Holi	Chamba	32.327142°N, 76.556221°E
Ecotourism site	Sahoo	Chamba	32.592591°N, 76.225574°E
Ecotourism site	Paneo	Kinnaur	31.446159°N, 77.380572°E
Nature Park	Jhiri	Mandi	31.827478°N, 77.171959°E

3.3 SUSTAINABILITY ASSESSMENT OF ECOTOURISM ACTIVITIES

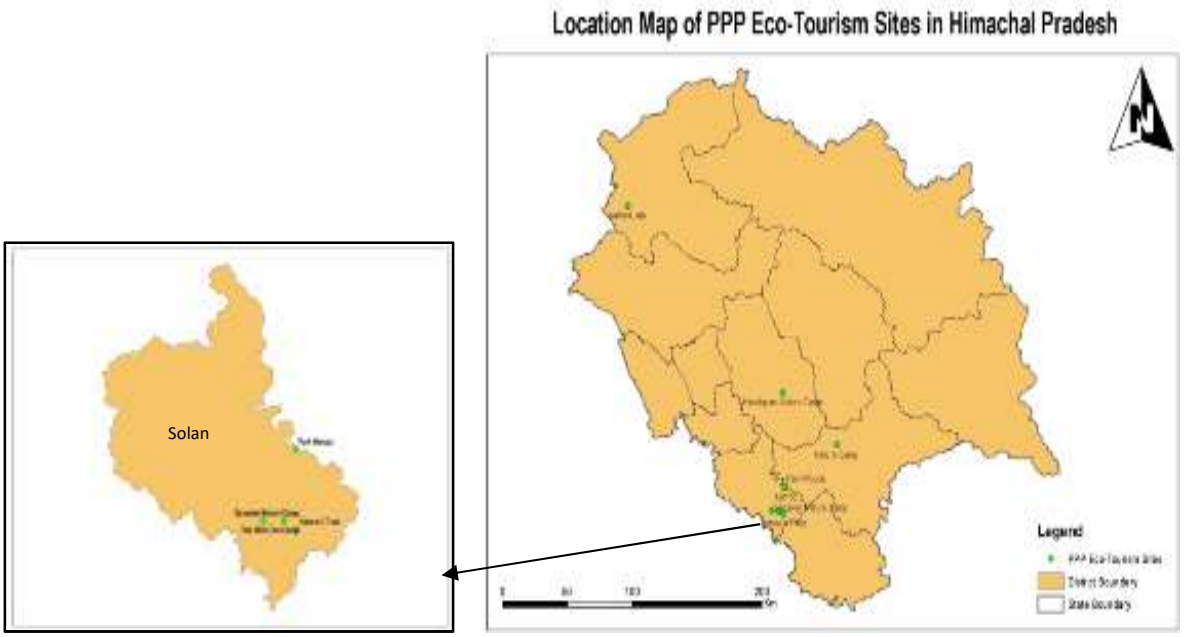
In order to assess the selected sites for sustainability and also for inter and intra comparison amongst the sites three criteria were selected (i) sustainability indicators, (ii) carrying capacity and (iii) status of water quality. The methodology used for analyzing sustainability using all the three criteria is given as follows.

3.3.1 Selection of indicators for sustainability assessment

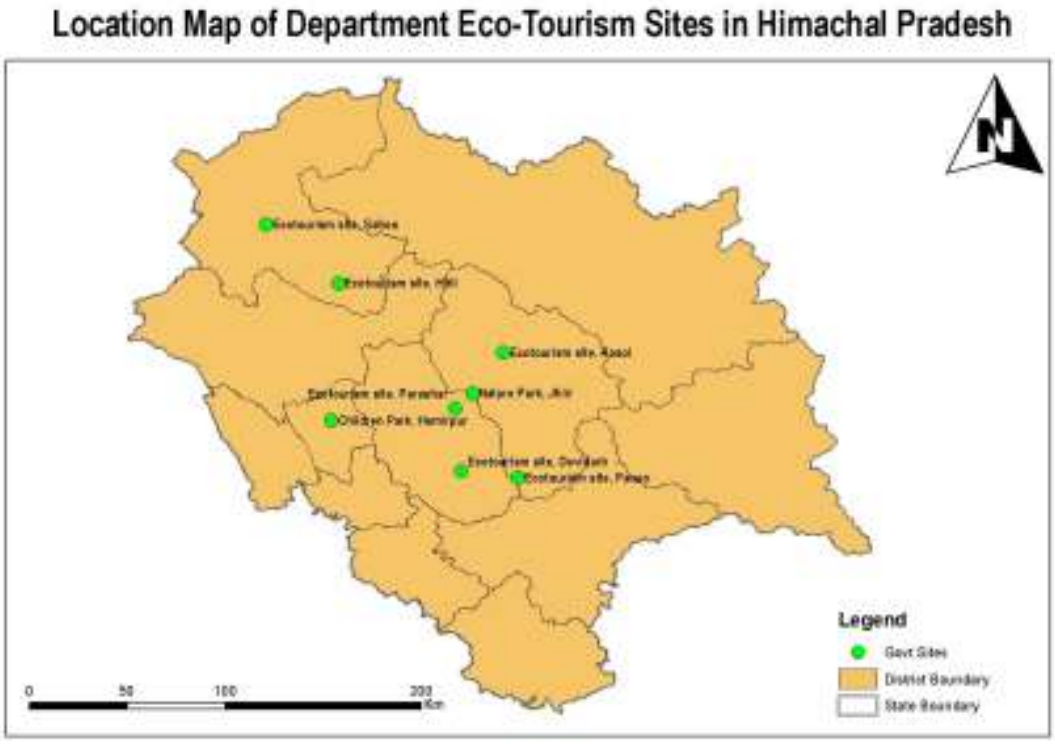
The sites were assessed for sustainability on the basis of nine key sustainable tourism indicators that were selected out of the extensive list of indicators given by the United Nations World Tourism Organization (UNWTO, 2004). Out of the total indicators given by the UNWTO, the ones which were found to be applicable and suitable for the area were selected based on literature and experts views. A guidebook on "Indicators of Sustainable Development for Tourism Destinations" was considered for deciding the indicators to be used (UNWTO, 2004). Various sustainability issues were considered to select indicators with the help of the guidebook and the practical application of these indicators in the field was done by conducting field survey, collection of primary and secondary data and also by referring to the case studies of their application. The selected indicators along with their units (where applicable) are given in table 3.3. The indicators were selected ensuring that they covered the three most important spheres of sustainability i.e. environmental, socio-cultural and economical and were grouped accordingly. The selected indicators covered a wide range of spheres from the satisfaction of local communities and tourists, to the management of resources like water and energy, waste management, employment, etc. Sustainability score was worked out for the sites depending upon the ratings given to the selected indicators. The methodology for assessment of sustainability of the sites based on indicators developed by Thomas *et al.* (2014) was used.

Table 3.3: Selected key sustainable ecotourism indicators

Sphere	Indicator	Type of indicator	Measure/Unit
Environmental	Energy Consumption/demand	State	Electricity units required
	Waste management	State	Disposal Method and amount of waste generated
	Bio-capacity	State	Resource base
	Infrastructure	State	Building material used
Socio-cultural	Potable water	State	Amount required and source
	Cost to users	Response	Rs/night
	Tourist facilitation	State	Availability and type of facilities and activities
Economical	Local employment	Response	Number
	Community Involvement	Response	Qualitative measure



Map 3.1: Spatial distribution of PPP ecotourism sites in Himachal Pradesh



Map 3.2: Spatial distribution of Departmental ecotourism sites in Himachal Pradesh

3.3.1a Details of selected indicators

Energy consumption/demand (Indicator 1)

To ensure that the ecotourism site may not compete with the energy requirement and consumption of the surrounding habitations this indicator was selected. The indicator was also considered for maintaining environmental quality through energy conservation by reducing load on conventional energy supply and by use of alternative renewable energy sources like solar electrification and biogas. This indicator was quantified and assigned an impact value; on the basis of energy audit of all the sites on a comparative basis.

Waste management (Indicator 2)

For ensuring environmental safety through waste management this indicator was selected. To assign a value to this indicator, observations were made on segregation of its recycling/composting or collection by MCDs or use of other disposal methods. Further grey water disposal technique adopted was also considered. Greywater is defined as wastewater without any contributions from toilet water (Casanova *et al*. 2001; Ledin *et al.* 2001; Ottoson and Stenstrom 2003). As most of the eco-sites are either located in the forest areas or in the far outskirts of the nearby cities without any proper sewage system, only conventional septic system with leach field for handling of sewage water is generally present. Therefore, the indicator was ranked accordingly keeping in view the present management scenario.

Bio-capacity (Indicator 3)

Bio-capacity represents the total extension of ecologically productive land in an area. In other words, it is the potential capacity to supply natural services from local ecosystems (Patterson, 2002). In the calculation of bio-capacity, some level of the existing bio-capacity must be considered as untouchable for human use. Twelve per cent of the existing bio-capacity needs to be taken as indispensable for the conservation of biodiversity (Wackernagel and Rees, 1996). Accordingly, this indicator was ranked keeping in view the availability of surrounding resources and open space with sparsely available trees for setting tents, sports activities, etc. in the surroundings that can be harnessed and utilized for the purpose of ecotourism. The conservation/management efforts to keep the locally available resources and surrounding environment preserved and protected for sustenance of the activity were also considered.

Building Material/Infrastructure (Indicator 4)

In order to rank this indicator, type and amount of infrastructure, material used for the development of the site and paths was considered. The excess of concrete structures violate the norms of ecotourism as the concrete building material or infrastructure can cause increase in impervious surface and can further decrease the amount of water infiltration into the ground.

Potable water demand (Indicator 5)

Water is life, however under changing environmental situation it has now become a scarce commodity and hence its use should be judicious. Ecotourism does require a continues water supply to meet the demand of guests and staff all around the year. Therefore, efforts to use it efficiently, especially through alternative means (rain water harvesting, watershed management, etc.) are of particular importance when assessing the sustainability of operations. The amount of water required, water usage, source availability and facilities for storage at a particular site was considered to quantify this indicator.

Cost to users (Indicator 6)

Value is more important than price but accurate pricing allows for the preservation of the eco-tourism product as well as the site (Panda *et al*. 2004). Pricing of the eco-tourism activities and products needs to be feasible for tourists as well as should allow for the sustainable functioning of the destination. Hence, site wise per day pricing per person was considered to quantify this indicator.

Tourist facilitation (Indicator 7)

Tourists' satisfaction is considered as one of the most important indicator in order to assess the sustainability and scope of improvement for ecotourism industry. In order to rank this indicator the visiting tourists were questioned at the site regarding accommodation, food and other recreational facilities like adventure sports, trekking routes, etc. available, in addition to the accessibility of the site.

Local Employment (Indicator 8)

WTO has listed the need for continuous employment of locals to ensure a steady supply of indirect revenue for the community and potential employment for the onsite

ecotourism activities as a major indicator for the survival of any tourism venture. Ecotourism being an activity closely related to nature and nature based activities like tracking, camping, bird watching etc. It is important to have readily available workforce in the area for such activities to take place. This will enhance local involvement and also help to reduce migration of the youths to cities in search of employment. The frequency, certification or plans for such activities and work satisfaction amongst the workers was considered for rating this indicator. Furthermore, the number of local employees involved in the activities was considered favorable and positive for reducing the impact of ecotourism on the ecosystem.

Community involvement in ecotourism activities (Indicator 9)

Local community involvement is considered almost mandatory for maintaining sustainability of ecotourism activities. To measure this impact, the level of community involvement was analyzed to determine the role of community in the functioning of ecotourism activities onsite. The community should have access to analyzed information and encouraged to participate in the decision making processes of the area, especially potential impacts in local economies, environment and culture. Though Ecotourism is a part of the State policy at higher level which can be seen in the form of the Ecotourism policy 2005 that has been revised in 2016 and 2017 as well as the HP tourism Policy 2019. But in order to rate this indicator observations were made that whether the ecotourism framework was included at the local level or not.

3.3.1b Ranking of Sustainability Indicators:

A social surveying technique including semi-structured interviews with locals, staff involved in the activity, screening and scoping, a community survey and self observations was followed. Data on various components of environment, socio-culture and economics was collected for each site required to rank the sustainability indicators. The data on various characteristics like demography, community involvement in the ecotourism activities, resource management and response of the locals on ecotourism and its potential for their up-liftment (Oppenheim, 1992) was collected. To select people for interview a non-probability sampling technique given by Fink (2003a, 2003b) was used. The managers, senior staff at the site and their relatives involved in the ecotourism activities were excluded.

On the basis of the information and data collected as well as the response received through interview, weight on a scale of 0 (no impact) to 5 (high impact) was assigned to each

indicator. Results were obtained by rank analysis using Kruskal Wallis H Test for inter comparison between PPP and Departmental ecotourism sites and graphical representation was done for the purpose of results interpretation. The Kruskal-Wallis H test also called the "one-way ANOVA on ranks", a rank-based non-parametric test was used to determine statistical significant differences between the sites on a continuous or ordinal dependent variable. Non-parametric alternative to the one-way ANOVA, and an extension of the Mann-Whitney U test was done in order to compare the sites. Finally, bar charts were developed using MS Excel for the comparison of ranks obtained by various indicators at all the selected sites. An impact value closer to the y-axis for any given indicator as indicated in the bar chart was considered more preferable. For intra-comparison of the PPP ecotourism sites and the Departmental sites in terms of sustainability, Mann-Whitney U test was used to compare differences between two types of sites as the dependent variable is ordinal/continuous, and not normally distributed. Both the analysis was done using SPSS statistical software. The bar charts were used for interpreting the comparison between the sustainability status of both types of sites. Despite most indicators having a quantifiable unit of measure, the assignment of impact values is based highly on perception, self observation and response received from the respondents.

3.3.2 CARRYING CAPACITY ASSESSMENT

3.3.2a Tourism Carrying Capacity (TCC)

The maximum number of people that may visit a tourist destination at the same time, without impacting negatively the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction.

A methodology to determine different carrying capacities i.e, the Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC), Management Capacity (MC) and Effective Carrying Capacity (ECC) developed by Cifuentes (1992) for tourism in protected areas was used in the present study, as per details given below:

3.3.2b Physical Carrying Capacity (PCC)

PCC is the maximum number of people that can fit at a particular site at any given time and still allow them to be able to move freely. PCC can be calculated as per the equation:

$$PCC = A \times \frac{V}{A} \times Rf$$

Where, A - Available area for use (m^2)

V/A= D - Tourist density (tourists m^{-2})

Rf - Rotation factor (No. of visits day^{-1})

3.3.2c Real Carrying Capacity (RCC)

Real Carrying Capacity is maximum amount of visits that a site can support, and is calculated by multiplying the PCC by a set of correction factors that are defined for each specific site. The correction factors used in the present study included environmental and social variables, as described below.

Limiting/Correction Factors

$$Cf_n = 1 - M_L/M_T$$

Where, Cf_n = Limiting value

M_L = Number of days of limiting factor each year

M_T = Number of days that ecotourism sites are open every year (365).

Environmental Variables as Correction Factors

Precipitation **(Cf_1):** Rainfall more than 30 mm was considered as limiting factor for tourism. An average of 12 years was calculated for the number of days with rainfall greater than 30 mm per year for Himachal Pradesh (Ponni and Baskar, 2015).

Very hot days **(Cf_2):** Temperature more than 30°C is considered as limiting factor for tourism. An average of twelve years was calculated for the number of days with temperature more than 30°C per year for the region of Himachal Pradesh (Ponni and Baskar, 2015).

Very cold days **(Cf_3):** Temperature less than 3°C is considered as limiting factor for tourism. An average of twelve years was calculated for the number of days with temperature less than 3°C per year (Ponni and Baskar, 2015). The meteorological data was collected from the Department of Environmental Science and IMD regional office at Shimla.

Social Variable (Cf_4): The number of tourists occupying the site should always be less than the total accommodation available in the site to avoid the interference of groups with each other and at the same time to provide a quality experience for the visitors. Therefore, even if a site can accommodate five groups according to its infrastructure, it was supposed to accommodate only three groups at a time.

Number of groups actually accommodated (M_L) = 3

Total number of groups that can be accommodated in the site (M_T) = 5

$$Cf_4 = 1 - \frac{3}{5} = 0.4$$

RCC is than calculated by multiplying the PCC by the above mentioned limiting factors as given in the following equation

$$RCC = PCC \times Cf_1 \times Cf_2 \times Cf_3 \times Cf_4$$

3.3.2d Effective Carrying Capacity (ECC)

ECC was calculated by considering the maximum amount of visits that can be allowed, given the capacity of the site to manage them and was obtained as per the given equation:

$$ECC = RCC \times MC$$

3.3.2e Management Capacity (MC)

The optimal MC refers to the ideal conditions for developing the activities that are planned for a given protected areas (Maldonado, 2000). For the present study, infrastructure, equipment and personnel were the variables influencing visitation and hence were considered in calculating MC.

The variables of infrastructure and equipment were valued according to three basic criteria: amount, status, and functionality. These criteria were valued and quantified subjectively using a 1-3 scale, ranging from not satisfactory (1) and very satisfactory (3) based on information gathered through interviews through questionnaire.

Rating of ecotourism facilities:

Infrastructure:

The number and type of accommodation available in the form of rooms, tents, cottages, etc., at each site was rated on the basis of the data collected with respect to amount, status and functionality (Table 3.4).

Amount*:* To quantify the total number of accommodation available at the site; a site with more accommodations was given a higher rating as compared to the site with fewer of them.

Status: To quantify the different types of accommodations. For example, similar type of accommodation was rated lower than the one with different classes like tents, rooms, etc.
Functionality: To quantify whether the infrastructure served the purpose of ecotourism. Rooms with more amenities and power consumption were rated lower than the ones with basic amenities.

The rating scales were formed keeping in mind the data collected from all the ecotourism sites and calculation was done using the following equation:

$$\text{Infrastructure management component (\%)} = \frac{Amount + Status + Functionality}{3 \times Highest\ Rating} \times 100$$

Table 3.4: Rating for infrastructure variables of the ecotourism sites

Rating	Variables of infrastructure		
	Amount	**Status**	**Functionality**
1	1-10	Similar type of accommodation	Power point+ source of light+ fan+ heater + geyser+ AC
2	11-15	2 types of accommodation	Power point+ source of light+ heater + geyser or Solar lamps
3	16-20	3 types of accommodation	Power point+ source of light+ fan+ heater
4	21-25	4 types of accommodation	Power point+ source of light+ fan
5	>25	5 types of accommodation	Power point+ source of light/solar lights

Facilities/Equipment at ecotourism sites:

It referred to all the activities that were taking place in the ecotourism sites. *Amount*: to quantify the number of activities those were taking place in the site. Status and functionality quantify their condition and if they are serving the purpose well. More the number of activities more was the rating given.

Staff position and their competence:

To evaluate the personnel, the following criteria were used: number of personnel, their level of education, and years of experience in the industry and level of satisfaction with working conditions. For each category being considered, a number in a scale of 1-3 (1 = not satisfactory, 3 = very satisfactory) was assigned. The rating scales were formed keeping in mind the data collected from the ecotourism sites.

$$\textit{Educational qualification} = \frac{\sum(\text{No.of employees} \times \text{Rating as per Qualification})}{\text{Total number of respondents}}$$

$$\textit{Experience of the employees} = \frac{\sum(\text{No.of employees} \times \text{Rating as per Experience})}{\text{Total number of respondents}}$$

Rating was given for this parameter based on the response of the personnel of the sites. The management capacity for the ecotourism sites was calculated as an average of these three variables: infrastructure, equipment and personnel, according to the following formula:

$$MC = \frac{\text{Infrastucture+Ecotourism activities+staff position and their competence}}{3}$$

Table 3.5: Rating for staff position and their competence of the ecotourism sites

Rating	Variables of personnel			
	Number of personnel	**Educational Qualification**	**Experience (years)**	**Training received**
1	-	Illiterate	1 year or less	No
2	-	Below Metric	2 – 4	-
3	< 25	Metric	5 – 7	-
4	25 – 50	10+2	8 – 10	-
5	> 50	Graduate and above	>10	Yes

Determination of Temporal Projection for Carrying Capacity

To determine the time limit after which the ecotourism sites may lose their sustainability in terms og effective carrying capacity the following formula was used:

$$P_t = P_o\,(1+E)^t$$

Where, P_t = People at time t

P_o = Current tourist inflow

E = Growth rate

t = Projected time

3.3.3 ASSESSMENT OF WATER QUALITY

To study the status of water quality at different ecotourism sites in the state, three samples were randomly collected from each site. The water samples were collected and processed by following standard methods (APHA, 2012) and preserved by keeping them at a

temperature below 4°C but above freezing point for further analysis. Average reading of the three samples was considered to find the status of water quality.

Water Quality Analysis

The collected water samples were then analyzed for following parameters:

pH: It was determined directly by taking water sample in a100ml beaker and using pH meter model 510 of EIA Make and the observations were recorded.

Electrical Conductivity (EC): It was determined directly by taking water sample in a 100ml beaker and using EC/TDS meter model 1601 of EIA Make and the observations were recorded. Water EC was expressed in decisiemens per meter (dSm^{-1}).

Biological Oxygen Demand (BOD): BOD was estimated by using 5-day BOD test as per 5210B method (APHA, 2012). The pH of the water samples was adjusted within a range of 6.5-7.5. Water sample (157ml) was taken in BOD bottle and 5 drops of nitrification inhibitor was added and stirred properly. A gasket was kept on the BOD bottle and 5 drops of KOH solution were added and sensors were attached to the BOD bottle by using BOD system oxy-direct (Aqualytic Make). Then the BOD bottles were loaded in the system and kept in the incubator for 5 days at 20°C. BOD readings were recorded after five days and expressed as mg/l.

Total Dissolved Solids: It was determined directly by taking water sample in a 100ml beaker and using EC/TDS meter model 1601 of EIA Make and the observations were recorded. TDS was recorded in mg/l.

The water quality data was interpreted by using permissible limits of CPCB (2017) and WHO (1993) as per table 3.6.

Table 3.6: Permissible limit of drinking and domestic water quality parameters

Parameters	CPCB	WHO
pH	6.5-8.5	6.5-8.5
EC (dSm^{-1})	0.75	Not- mentioned
TDS (mgl^{-1})	500	1000
BOD (mgl^{-1})	5	5

(CPCB, 2017) and (WHO, 2017)

3.4. IDENTIFICATION OF POTENTIAL ECOTOURISM SITES IN HIMACHAL PRADESH

In order to identify the potential of ecotourism in the state five sample blocks in different districts were selected randomly (Table 3.7). Remote sensing and GIS techniques

were used to evaluate the suitability of the areas within the block. The main theme is to determine suitable areas relevant to tourism in selected blocks in relation to ecotourism resources and its ability to satisfy tourists and socioeconomic development of the region. Procedure followed, tools and techniques applied have been accomplished through discussions with experts, browsing authenticated literatures and analysis of historical data.

Table 3.7: Selected blocks for identification of ecotourism potential in Himachal Pradesh

Block	District	Agroclimatic Zone	Location	
			Latitude	Longitude
Chirgaun	Shimla	Dry Temperate High Hills	31°25'16.623" to 31°08'48.715"	78°05'22.777" to 77°54'05.322"
Kalpa	Kinnaur	Dry Temperate High Hills	31°05'36.67" to 31°41'30.812"	78°05'49.322" to 78°59'56.057"
Seraj	Mandi	Wet Temperate High Hills	30°25'25.879" to 30°43'18.915"	77°04'38.173" to 77°19'59.315"
Bharmaur	Chamba	Temperate High Hills	32°39'54.277" to 32°10'24.110"	76°20'7.062" to 76°52'49.655"
Sangrah	Sirmaur	Sub-Humid Mid Hills	30°51'51.363" to 30°34'53.522"	77°19'10.625" to 77°37'32.417"

Map 3.3: Selected blocks for potential ecotourism sites identification

Some important attributes like untouched landscape, freedom from urban settlements, rich vegetation cover and vicinity of recreational tourist attractions were considered in order to specify the criteria for determining the suitable ecotourism sites in the selected blocks. Weighted overlay analysis of the selected criteria was conducted using AHP (Analytical Hierarchy Process) technique to identify the suitable areas for ecotourism.

3.4.1. Potential ecotourism area identification

AHP weight were calculated using Microsoft excel by formulating proper matrices which were further used in the suitability map producing process. The suitability maps for potential ecotourism area were prepared by following the five given steps:

(1) Consideration of blocks for study
(2) Identification of suitable factors for potential ecotourism site identification
(3) Assigning of factor priority, weight and class weight (rating) to the parameters involved
(4) Relevant data collection for generation of suitability layers for ecotourism in GIS software
(5) Determination of ecotourism potential areas in the selected blocks

Detailed explanation and each processing step of the methodology and tools applied for the identification of ecotourism sites is depicted in Fig. 3.2.

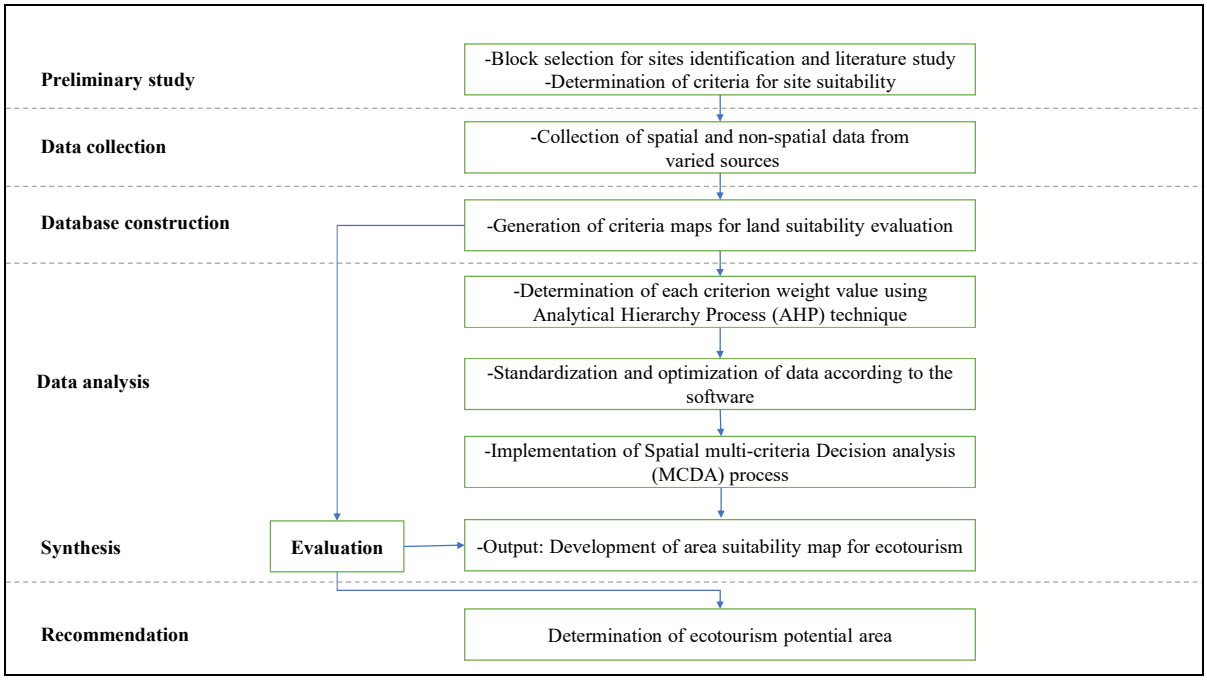


Fig. 3.2: Procedure followed for identification of potential ecotourism areas

3.4.2. Determination of Factors and Classification of Criteria for Potential area Identification

The factors and criteria that are important for ecotourism site identification used were chosen on the basis literature, interviews and questionnaires answered by experts and ther relevant information gathered during study. The factors like water availability, landscape/naturalness, topography, accessibility and community characteristics were considered. Similar type of factors were also identified by Bunruamkaew and Murayama, 2011 as indicators (landscape/naturalness, wildlife, topography, accessibility, community characteristics, land use/cover, reservation/protection, elevation, slope, proximity to cultural sites, distance from roads and settlement size) of land suitability for potential ecotourism site identification within land ecosystems.

Table 3.8: Selected Criteria/Factors for land suitability analysis

Criteria/Factors	Classes	Ranking	Suitability
Slope (Degree)	0– 15^0	1	Highly suitable
	15– 25^0	2	Moderately suitable
	25– 40^0	3	Marginally suitable
	More than 40^0	4	Not suitable
Elevation (Meters)	Varies from block to block	1	Highly suitable
		2	Moderately suitable
		3	Marginally suitable
		4	Not suitable
Aspect (Direction)	South	1	Highly suitable
	East	2	Moderately suitable
	West	3	Marginally suitable
	North	4	Not suitable
Water Availability (Distance in Km)	Less than 1Km	1	Highly suitable
	1Km – 1.5Km	2	Moderately suitable
	1.5Km – 2Km	3	Marginally suitable
	More than 2Km	4	Not suitable
Accessibility (Distance from nearest road in Kilometer)	Varies from block to block	1	Highly suitable
		2	Moderately suitable
		3	Marginally suitable
		4	Not suitable
LULC (Classes)	Grassland	1	Highly suitable
	Forest	2	Moderately suitable
	Horticulture and Barren/rocky area	3	Marginally suitable
	Snow, Glacier, Agriculture, Water body, build up area	4	Not suitable
Population (Size in number)	0 – 150	1	Highly suitable
	150 – 300	2	Moderately suitable
	300 – 500	3	Marginally suitable
	More than 500	4	Not suitable
Tourist Spots (Distance in Kilometer)	Less than 5 Km	1	Highly suitable
	5 – 10 Km	2	Moderately suitable
	10 – 15 Km	3	Marginally suitable
	More than 15	4	Not suitable

A standard nine-point scale preference scoring system, was taken into consideration to allocate the relative weights to the selected criteria (Ananda and Herath 2002; Satty and Vargas 2001). Applicable criteria with sub-classes, rating and suitability classification considered for the purpose are given in Table 3.8 and for individual block is depicted in Appendix (XIII to XVII). On the basis of the weights and ratings obtained by the criteria, selected sites were divided into four suitability categories namely: highly, moderately, marginally and not suitable.

3.4.3. Assembling of Required Datasets

Data from varied sources was assembled for this study including Global Positioning System (GPS) locations, statistical reports and other GIS datasets. The data used for the investigation is depicted in table 3.9. GIS-based land suitability analysis has been applied for analyzing site suitability and accuracy of administrative boundaries of the selected blocks.

Table 3.9: Spatial and non-spatial data used for layer creation in GIS software and data source

Dataset/Layers	Scale	Source
Boundary Map of blocks	1:50000	Revenue Department
Drainage	1:50000	Hydrological modeling of DEM
Land use land cover	1:50000	Sentinel-II Satellite data (10m resolution) (USGS website)
Topography (Elevation)	1:50000	ALOS-DEM (12.5m resolution)
Topography (Slope)	1:50000	1st derivative of DEM
Topography (Aspect)	1:50000	2nd Derivative of DEM
Road Network Map	1:50000	Public Works Department
Population	1:50000	Census Data 2011
Tourist Spots	1:50000	Tourism Department Website
Co-ordinates	1:50000	Google Earth

3.4.4. Map generation and classification

For each criteria data layer were generated through ArcGIS software for spatial analysis. Criteria wise layer generation, their classification and processing was done as per the procedure given below:

Water Availability: As per the weights obtained by various criteria/factors selected by AHP technique for ecotourism site suitability, water came out as the most important factor with a weight value of 0.42 (Table 3.11). Accordingly water was considered crucial factor while selecting an area for the setup of any ecotourism venture due to its vivid use. The water

drainages were delineated using a digital elevation model (DEM) in raster format, which carries elevation information. The surface water flow direction of each cell was estimated by the elevation value of the cell as directed to the neighboring cell with the steepest downslope drop and drainage pattern of the area was delineated by using SWAT hydrological model along with outlet points. To assess the water availability the perennial water sources were considered such as springs and rivulets keeping in view the daily requirement of water the seasonal water sources were not considered for the study. For ranking and assessing the suitability of water source availability, the distance of the suitable area from the water source was considered (Table 3.8). The shape files (.shp) were created using BUFFER tool based on the distance of the area from the water source, and were ranked based on suitability. Finally, the ranking for the various suitability classes was added in the attribute table of the derived shape files in the GIS software. Water availability map (Map 3.4d, 3.5d, 3.6d, 3.7d and 3.8d) for all the selected blocks were also created from the final obtained layer.

Land Use land Cover (LULC): The next highest weighted criterion is LULC with a weight value of 0.28.The LULC thematic maps of selected blocks were generated from current vintage data of Sentinel-II satellite data downloaded from USGS Earth Explorer for the 27th September 2019. A total number of four band layers; Blue, Green, Red (BGR) and Near Infra-Red (NIR) were stacked and re-sampled at a spatial resolution of 10 m with minimum snow cover. The downloaded satellite data was already geo-referenced and terrain corrected. For Slope and DEM/elevation layer ALOS satellite data with 12.45m resolution was used, on which elevation model was applied and further classification was done. Further methodology used for LULC map generation of the study area is given below:

Normalized Difference Vegetation Index (NDVI) quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). NDVI always ranges from -1 to +1. NDVI is calculated by using following equation:

$$NDVI = \frac{(NIR-RED)}{(NIR+RED)}$$

For the purpose of classification, all the four bands; Blue, Green, Red, NIR and the NDVI image were stacked. Object oriented approach was used for the final classification wherein the image is divided into objects by using multi-resolution segmentation. In a

supervised classification algorithm, sample objects were selected for all the classes from the segmented image. The mean of the selected bands were used as object features for differentiating classes from each other. Finally, nearest neighborhood classification algorithm was applied. Certain anomalies in classified output were removed using manual editing tool. The results were then exported as ESRI shape files into GIS software and area calculation for different classes was done. The Land Use and Land Cover classes were derived as polygons and were ranked accordingly. The ranking and suitability of various LULC classes for ecotourism suitability is given in table 3.8, which was added in the attribute table of the derived shape files in the software. The finally generated layer of LULC for all the study blocks is presented through Map 3.4f, 3.5f, 3.6f, 3.7f and 3.8f.

Topography: Topography with a weight value of 0.13 as represented by three sub-criteria namely elevation, slope and aspect was also considered as one of the criteria for selecting a place suitable for ecotourism. A digital elevation model (DEM) in raster format, that carries elevation information was used. For this study ALOS DEM, which is freely available and can be downloaded from ASF (full form) vertex was used. Firstly, in order to generate a layer for elevation, the block boundary was overlaid on the downloaded DEM and the selected block areas were extracted in raster format. The ranking and suitability of the elevation of the selected blocks varies from block to block and the derived elevation for the particular block was classified according to the defined suitability classes (Table 3.8). Secondly, a layer for slope which is the first derivative of elevation was derived from DEM in ArcGIS software using SLOPE tool in Spatial Analyst Module for all the selected blocks. The output slope values were taken in degrees and the ranking and the suability for various classes of slope can be seen in table 3.8. The third sub-class of topography is aspect, i.e., the orientation w.r.t. to sun can was derived from the DEM as it is the second derivative of elevation. Major aspects; North, South, East and West were derived from the layer, the ranking and suitability for desired aspect classes was done as per table 2.

Ranking and suitability for various topography features was classified according to the defined suitability classes. For this purpose, RECLASSIFY tool in SPATIAL ANALYST of ArcGIS module was used and the available classes were ranked accordingly. The final raster data obtained for all the three sub-classes of topography was converted to vector format using RASTER TO POLYGON tool available in

CONVERSION module of ArcGIS. The ranking i.e. the suitability was added in the attribute table of the derived shape files. Map 3.4a, 3.5a, 3.6a, 3.7a and 3.8a, represents slope layer; Map 3.4b, 3.5b, 3.6b, 3.7b and 3.8b, represents elevation/relief layer and Map 3.4c, 3.5c, 3.6c, 3.7c and 3.8c, represents aspect layer for the selected blocks respectively.

Population: The next important criterion is population with weight of 0.09 that was also considered as a criteria. Population data taken from official website of Census of India, 2011 was considered for the purpose. The spatial attributes i.e., the coordinates for the population distribution according to the villages, towns and cities was extracted from Google earth and a point layer was created for the population data. A .csv file was generated using MS Excel for use in the GIS software. These settlements were ranked according to the number of people in an area (Table 3.8). A buffer of 3 kms was created around the settlements using BUFFER tool in ANALYSIS Module of ArcGIS. The common areas of these buffers were eliminated using ERASE tool in ANALYSIS Module of ArcGIS, and the rest of the area was considered for study. The ranking for the desired suitability class was added in the attribute table of the derived shape file of the selected blocks. The final obtained layers for all the blocks are represented by Map 3.4g, 3.5g, 3.6g, 3.7g and 3.8g.

Accessibility: The accessibility criteria having a weight value of 0.05 were also created for all the selected blocks. For this purpose, an already created layer of roads for the whole state was procured from Public Works Department of Government of Himachal Pradesh in form of shape file (.shp format). Finally, the BUFFER tool was used for creating shape files according to the rankings given in the table 3.8. The ranking i.e., the suitability was added in the attribute table of the derived shape files. Map 3.4e, 3.5e, 3.6e, 3.7e and 3.8e represents the final layers obtained after processing of the road .shp file according to desired suitability score for study blocks.

Tourist Spots: The data for famous tourist spots in the selected blocks was taken from the official website of the State Department for Tourism and Civil Aviation. The spatial attributes i.e., the coordinates for the tourist spots was extracted form Google earth and a point layer was created. Buffers around these spots were created using BUFFER tool according to the distance decided in the starting of study in ANALYSIS module of ArcGIS according to the classes given in the table 2. The common areas of these buffers

were eliminated using ERASE tool in ANALYSIS module of ArcGIS 10.7.1. The ranking for the suitability was added in the attribute table of the derived shape files.

Development of suitability maps

Finally, all the generated data layers were overlayed after analysis and a ecotourism potential site suitability map was developed for each selected block. On the basis of the ranking obtained by the criteria, block area was divided into four categories high suitable, moderately suitable, marginally suitable and not suitable. All the eight vector layers one for each criterion having rankings as 1, 2, 3 and 4 respectively, were overlaid in the attribute table to obtain classified criteria layer. This vector data was converted to raster format using FEATURE TO RASTER tool available in CONVERSION module of ArcGIS. Then these criteria layers were assigned weights and weighted rasters were obtained for each criterion. These weights were then multiplied with the assigned ratings for each class of every criterion to obtain raster with suitability score for each class. Each pixel value of the processed raster data for selected criteria were added using RASTER CALCULATOR available in SPATIAL ANALYST tool which was classified using RECLASSIFY tool in SPATIAL ANALYST further to obtain final suitability map. This raster data was converted to vector format using RASTER TO POLYGON tool available in CONVERSION module of ArcGIS for area calculation for each suitability class, i.e. highly, moderately, marginally and not suitable. Land use/Land cover map preparation, base map creation; layer Stacking of satellite image has been processed using ArcGIS 10.1 Software.

Table 3.10: Pair wise comparison matrix of the selected criteria/factors for potential ecotourism sites identification

Factor	C1	C2	C3	C4	C5	C6
LULC (C1)	**1.000**	3.000	5.000	0.333	5.000	7.000
Topography (C2)	0.333	**1.000**	3.000	0.166	2.000	5.000
Accessibility (C3)	0.200	0.333	**1.000**	0.142	0.333	2.000
Water (C4)	3.000	4.000	6.000	**1.000**	4.000	7.000
Population Size (C5)	0.200	0.500	3.000	0.250	**1.000**	3.000
Tourist spots (C6)	0.143	0.200	0.500	0.143	0.333	**1.000**
Total	**4.876**	**9.033**	**18.500**	**2.034**	**12.666**	**25.000**

3.4.5. Weight value determination for each criterion

The weights value for different factors and criteria was determined using, AHP - one of the most extended Multi-Criteria Decision Making (MCDM) techniques. This method

provides a structural basis for quantifying the comparison of chosen factors and criteria in a pair wise technique (Arabinda, 2003). Typically, the priority of each factor involved in the AHP analysis was determined by consulting experts (Tienwong, 2008), by asking to rank the value for the criterion on a Saaty's scale for a pair wise matrix (Table 3.10) on the basis of which further analysis was done (Appendix XVIII).

Relative significance of all the selected parameters is evaluated by assigning weight for each of the factor in a hierarchical order and in the last level of the hierarchy, the suitability weight for each class of the used factor is given. In order to ensure the credibility of the relative significance used, inconsistency of judgments was also determined mathematically in the AHP method in terms of consistency ratio. As shown in the given equation based on the properties of reciprocal matrices, the consistency ratio index (CR) was calculated. The CR measured value less than 0.10 was considered fairly acceptable (Saaty, 1980).

$$CR = \frac{CI}{RI}$$

Where, CR – Consistency Ratio

CI – Consistency Index

RI – Relative Index table value

During the analysis process Consistency Ratio was calculated and found to be 0.0403, and was considered suitability analysis. The calculations of pair wise comparison matrix and computation of consistency ratio are given in Tables 3.11.

Table 3.11: Factor wise weight and estimated consistency ratio

Factor	C1	C2	C3	C4	C5	C6	Sum	Weight	Consistency
LULC (C1)	0.21	0.33	0.27	0.16	0.39	0.28	**1.65**	0.28	6.32
Topography (C2)	0.07	0.11	0.16	0.08	0.16	0.20	**0.78**	0.13	6.25
Accessibility (C3)	0.04	0.04	0.05	0.07	0.03	0.08	**0.31**	0.05	6.10
Water (C4)	0.62	0.44	0.32	0.49	0.32	0.28	**2.47**	0.42	6.41
Pop. Size (C5)	0.04	0.06	0.16	0.12	0.08	0.12	**0.58**	0.09	6.24
Tourist spots (C6)	0.03	0.02	0.03	0.07	0.03	0.04	**0.22**	0.03	6.19
Sum	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**			

CI: 0.05 RI: 1.24 CR: 0.0403

3.4.6. Land Suitability Assessment

Based on the linear combination of each used factor's suitability score as calculated using Equation (3.4.3), the land suitability map for ecotourism was created for each selected block. The linear combination of suitability score obtained for each factor and criteria involved was used to calculate the total suitability score "Si" for each land unit (i.e. each raster cell in the map) and used in the GIS software.

$$Si = \sum_{i=1}^{n} (Wi\ X\ Ri)$$

Where, n - number of factors,

Wi - multiplication of all associated weights in the hierarchy of "ith" factor (as seen in Table 3.12) and

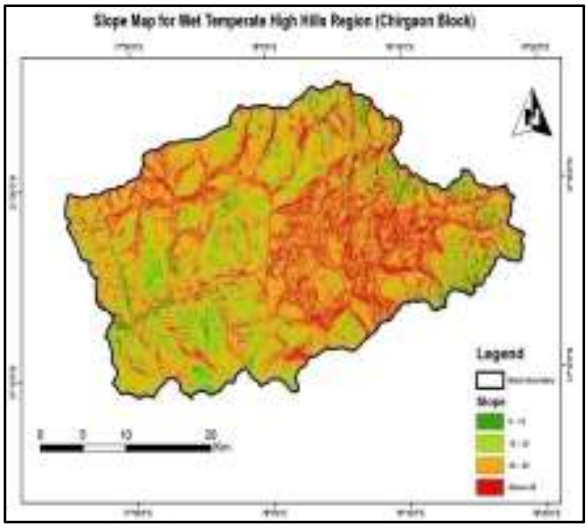
Ri - rating given for the defined class of the "ith" factor

In Multi Criteria Evaluation (MCE) using a weighted linear combination, the assigned weights need to be summed up to 1 for each category/subcategory defined. However, each factor in the last layer was classified into 4 suitability classes (S1, S2, S3, S4) and their suitability scores were presented in the standardized format ranging from 0 (least suitable) to 1 (most suitable). Finally, the total suitability score from each factor were assembled in the software to create site suitability map for ecotourism. The land suitability maps for ecotourism were created, based on the linear combination of each used factor's suitability score. The GIS-based model (modified from Baniya, 2008) for multi-criteria land suitability evaluation for ecotourism was considered for the present study.

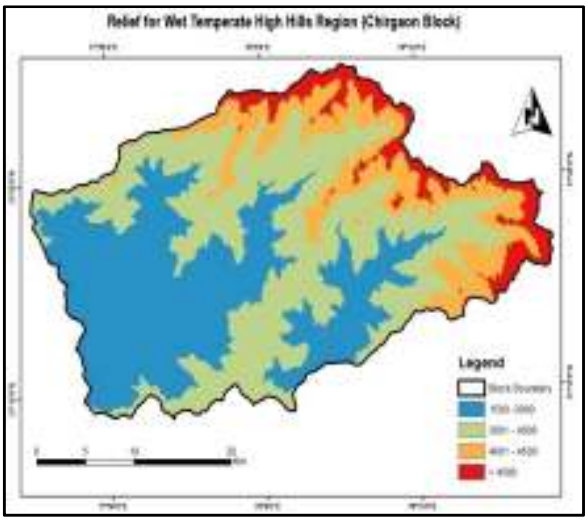
Table 3.12: Criteria and factor wise status of weights and ratings used for ecotourism site suitability analysis

Factors	Weight	Criteria	TSS	S1	S1Ri	TSSXS1Ri	S2	S2Ri	TSSXS2Ri	S3	S3Ri	TSSXS3Ri	S4	S4Ri	TSSXS4Ri
LULC	0.28	Classes	0.28	1	1.24	0.347	0.37	0.459	0.128	0.3	0.372	0.104	0.1	0.124	0.035
Topography	0.13	Elevation (0.45)	0.0585	1	1.24	0.073	0.67	0.831	0.049	0.45	0.558	0.033	0.3	0.372	0.022
		Slope (0.36)	0.0468	1	1.24	0.058	0.67	0.831	0.039	0.35	0.434	0.020	0.26	0.322	0.015
		Aspect (0.18)	0.0234	1	1.24	0.029	0.7	0.868	0.020	0.4	0.496	0.012	0.3	0.372	0.009
Accessibility	0.05	Nearby road	0.05	1	1.24	0.062	0.62	0.769	0.038	0.31	0.384	0.019	0.18	0.223	0.011
Water	0.42	Distance	0.42	1	1.24	0.521	0.6	0.744	0.312	0.5	0.620	0.260	0.2	0.248	0.104
Population	0.09	Number	0.09	1	1.24	0.112	0.59	0.732	0.066	0.3	0.372	0.033	0.15	0.186	0.017
Tourist Spots	0.03	Location	0.03	1	1.24	0.037	0.71	0.880	0.026	0.29	0.360	0.011	0.17	0.211	0.006

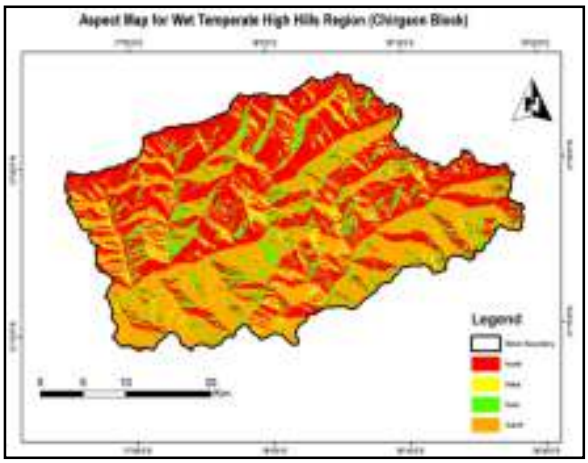
TSS – Total Suitability Score; S – Suitability; Ri – Table Value (1.24)



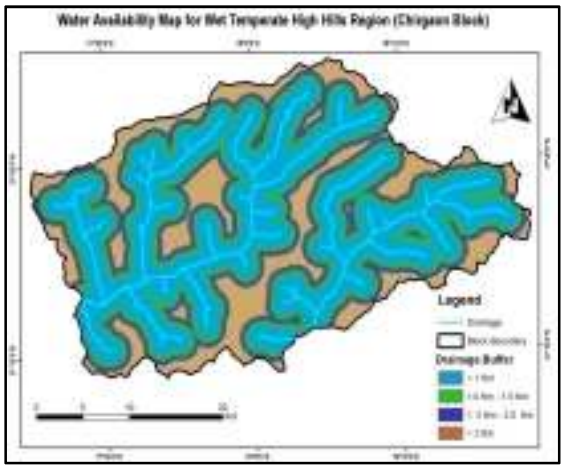
Map 3.4: Slope map for Chirgaon Block of Shimla District



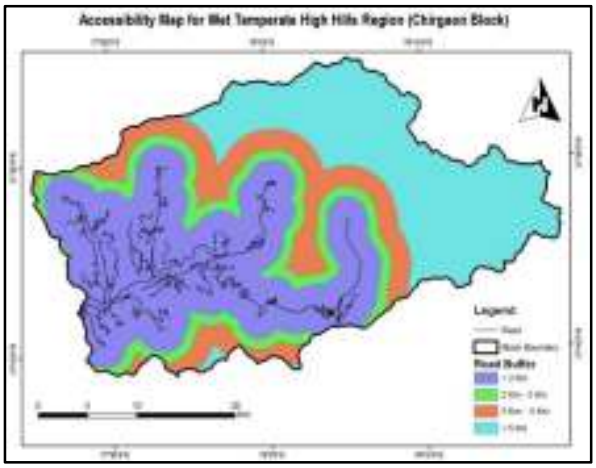
Map 3.5: Relief map for Chirgaon Block of Shimla District



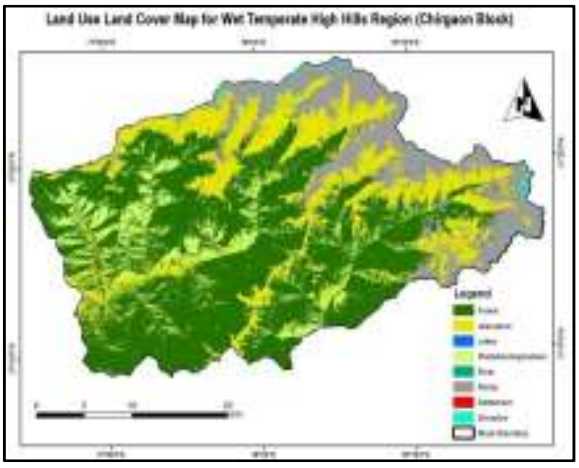
Map 3.6: Aspect map for Chirgaon Block of Shimla District



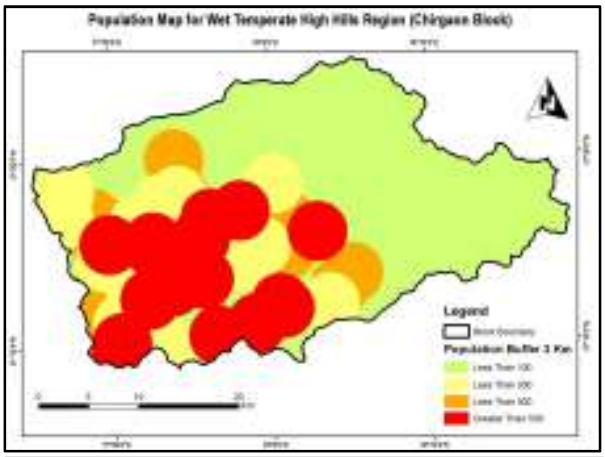
Map 3.7: Drainage/Water availability map for Chirgaon Block of Shimla District



Map 3.8: Road network/Accessibility map for Chirgaon Block of Shimla District

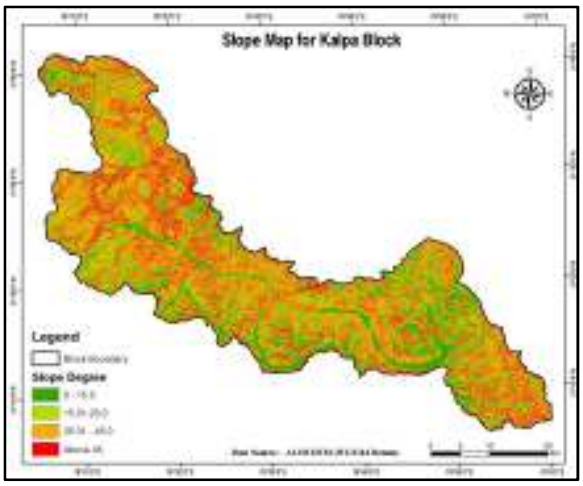


Map 3.9: LULC map for Chirgaon Block of Shimla District

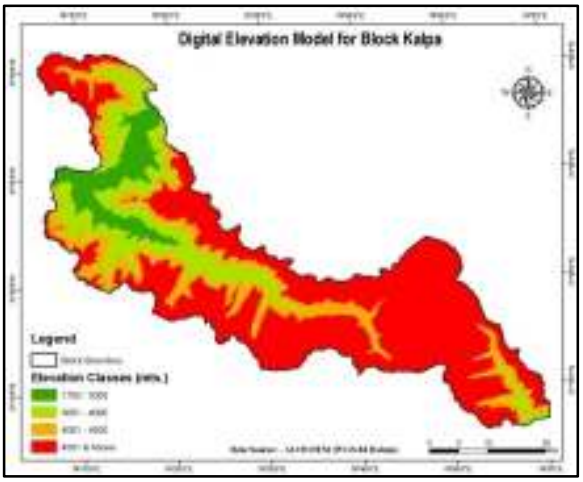


Map 3.10: Population distribution map for Chirgaon Block of Shimla District

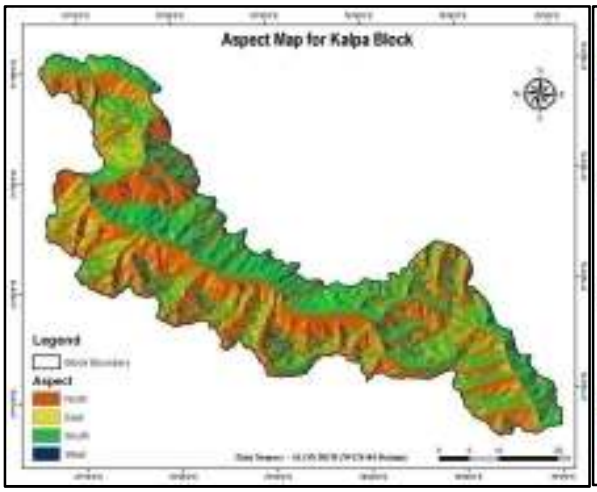
Map 3.4 to Map 3.10: Maps of different criteria layers for Chirgaun Block in Himachal Pradesh



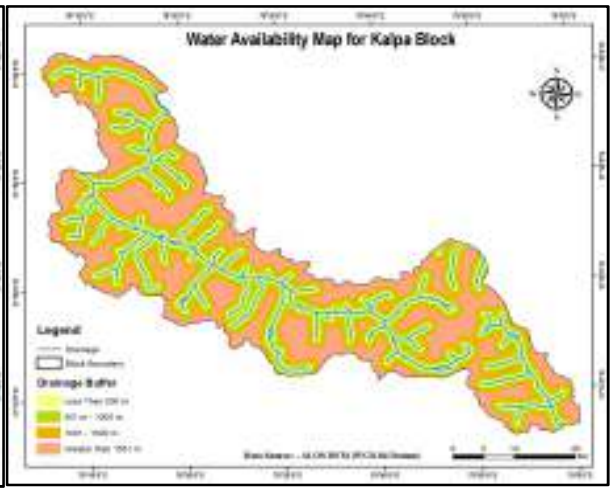
Map 3.11: Slope map for Kalpa Block of Kinnaur District



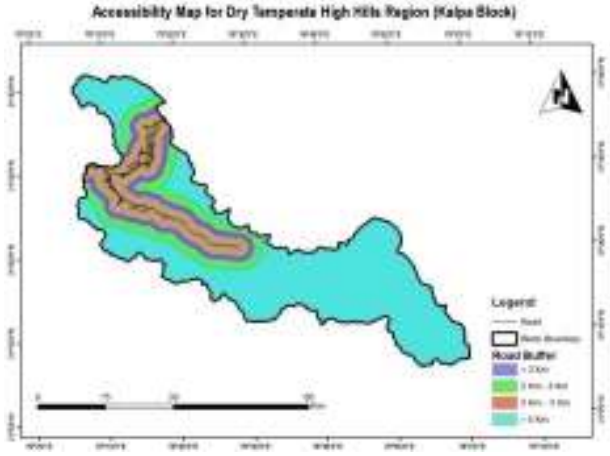
Map 3.12: Relief map for Kalpa Block of Kinnaur District



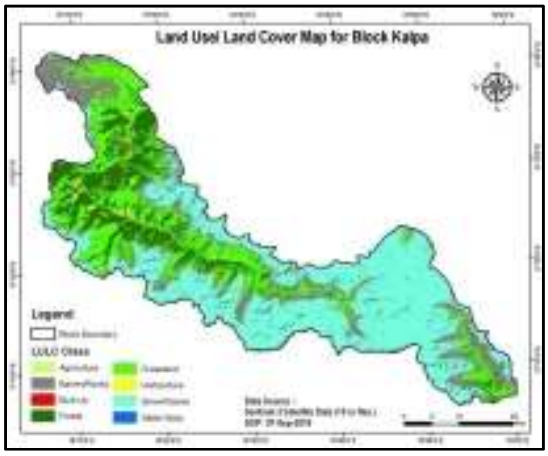
Map 3.13: Aspect map for Kalpa Block of Kinnaur District



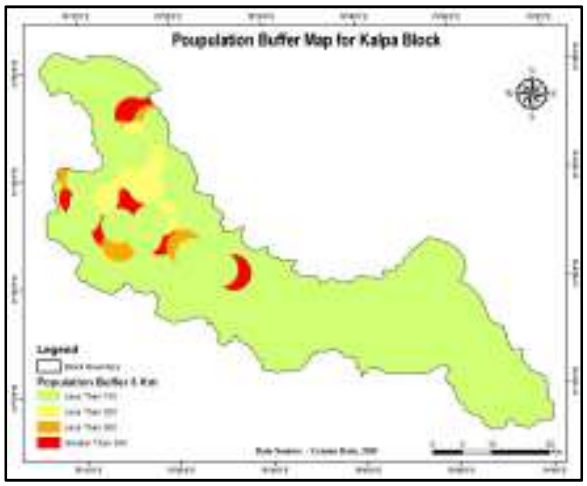
Map 3.14: Drainage/Water availability map for Kalpa Block of Kinnaur District



Map 3.15: Road network/Accessibility map for Kalpa Block of Kinnaur District

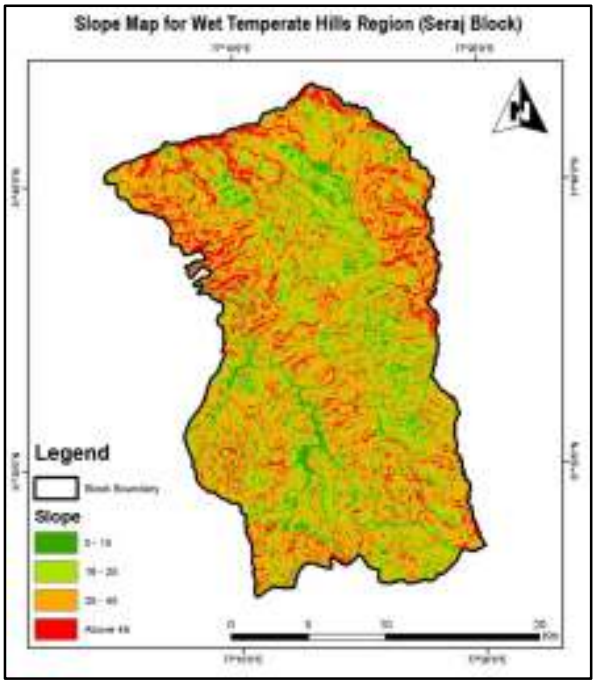


Map 3.16: LULC map for Kalpa Block of Kinnaur District

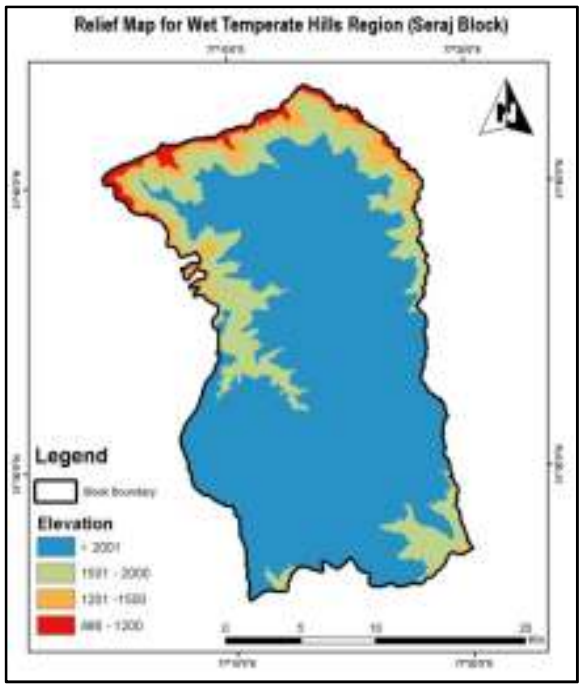


Map 3.17: Population map for Kalpa Block of Kinnaur District

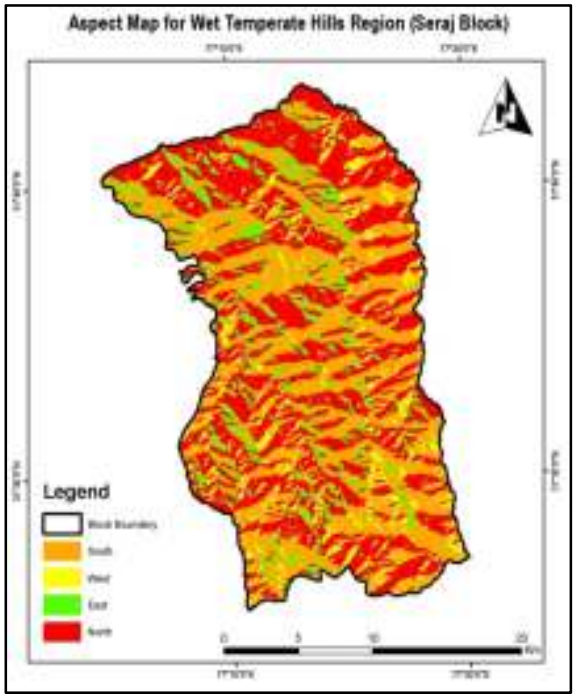
Map 3.11 to 3.17: Maps of different criteria layers for Kalpa Block in Himachal Pradesh



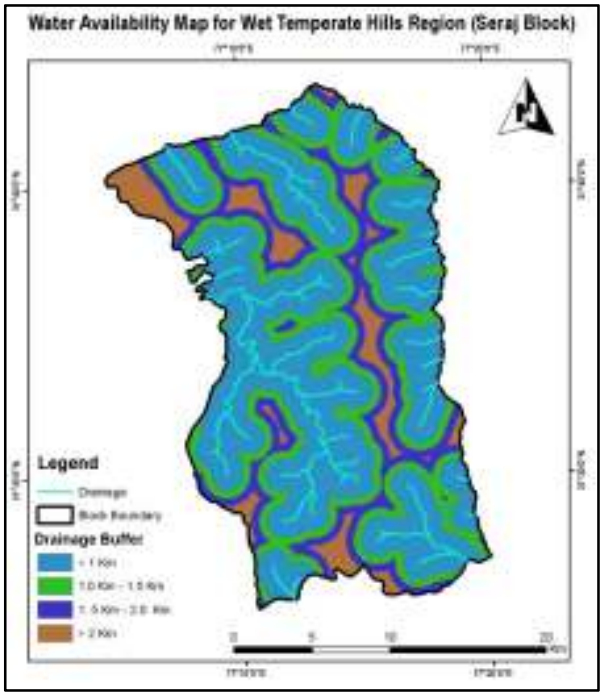
Map 3.18: Slope map for Seraj Block of Mandi District



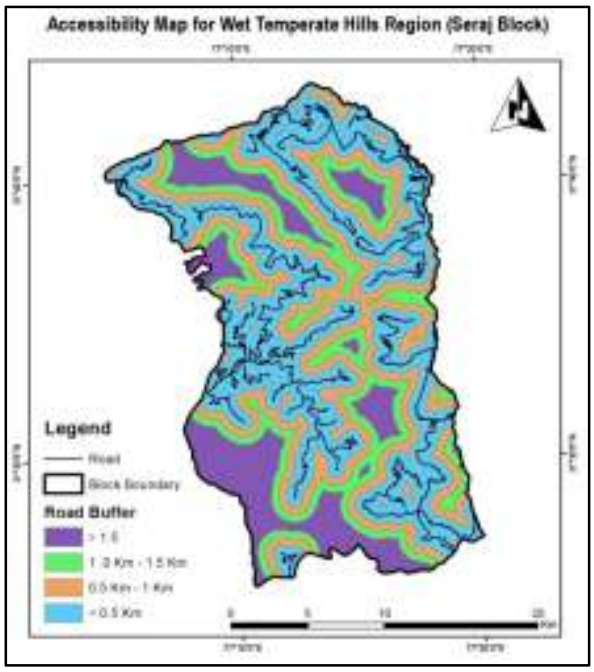
Map 3.19: Relief map for Seraj Block of Mandi District



Map 3.20: Aspect map for Seraj Block of Mandi District

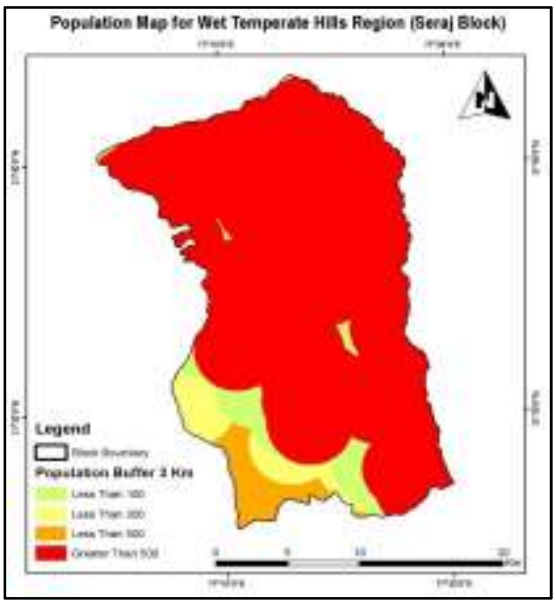


Map 3.21: Drainage/Water availability map for Seraj Block of Mandi District



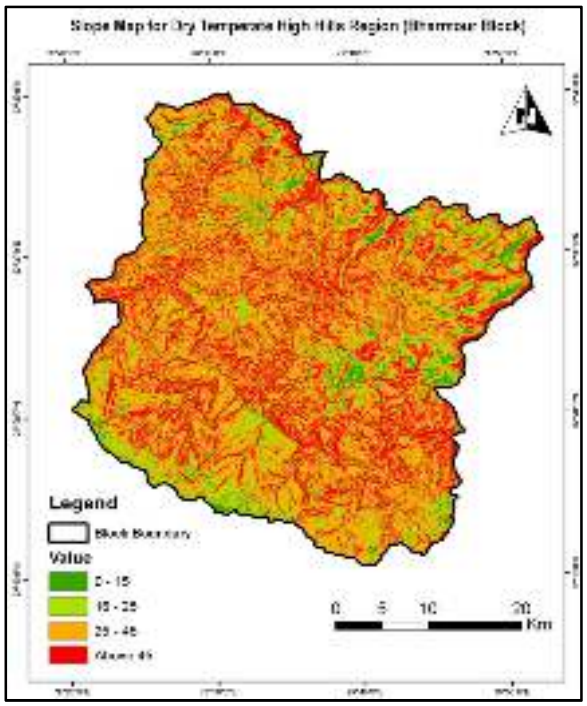
Map 3.22: Road network/Accessibility map for Seraj Block of Mandi District

Map 3.23: LULC map for Seraj Block of Mandi District

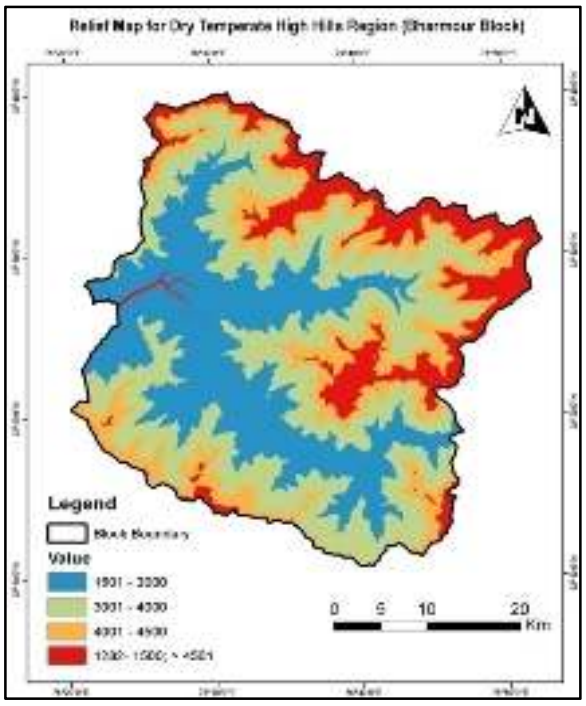


Map 3.24: Population distribution map for Seraj Block of Mandi District

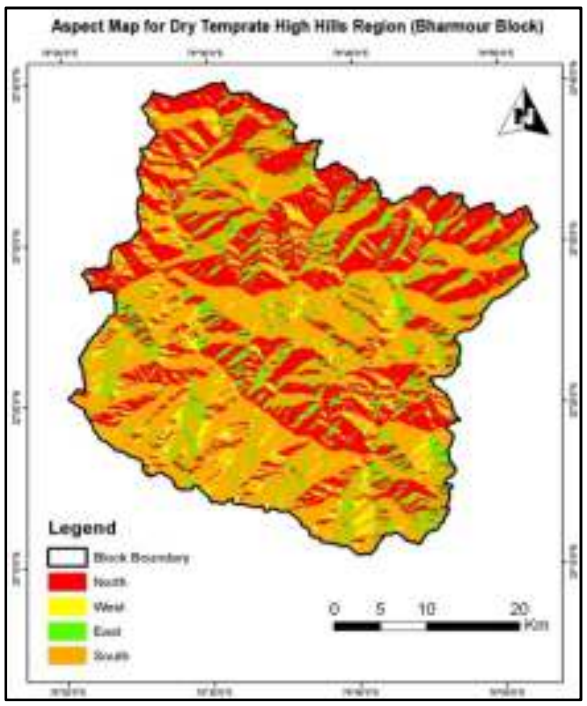
Map 3.18 to 3.24: Maps of different criteria layers for Seraj Block of Himachal Pradesh



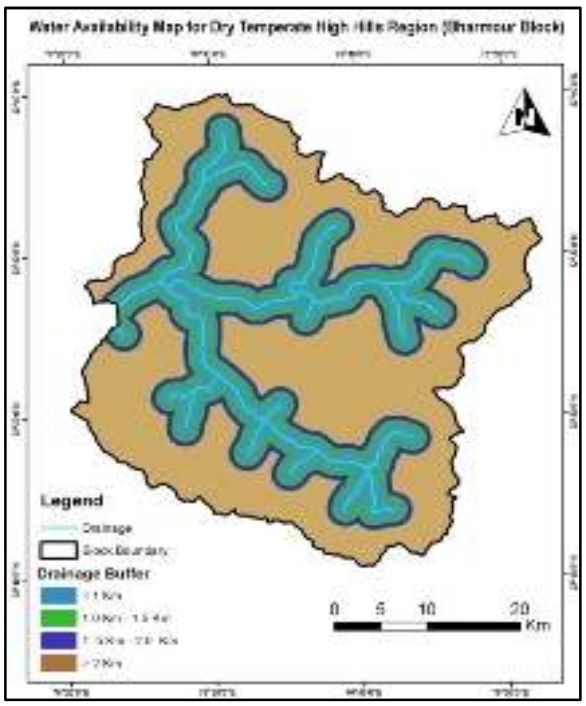
Map 3.25: Slope map for Bharmour Block of Chamba District



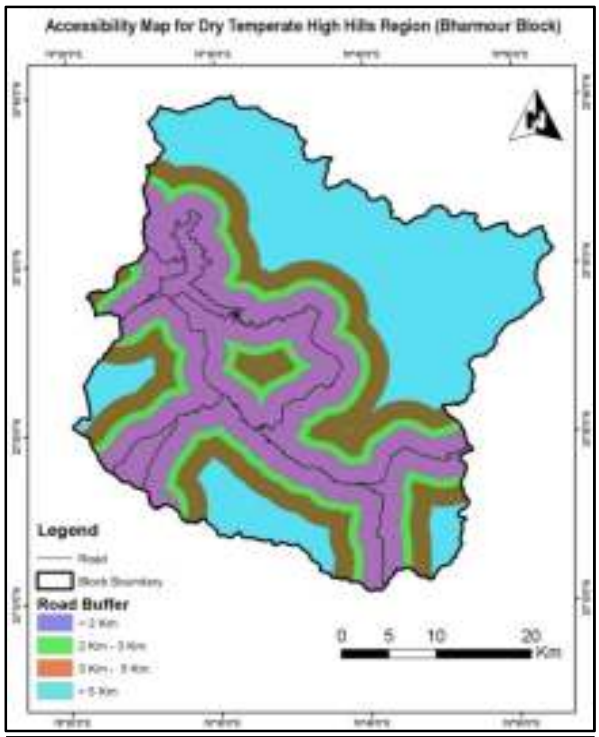
Map 3.26: Relief map for Bharmour Block of Chamba District



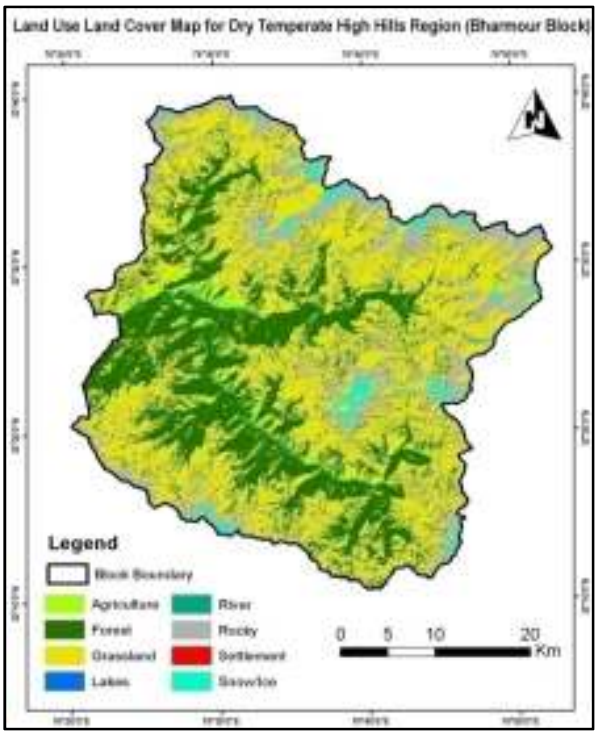
Map 3.27: Aspect map for Bharmour Block of Chamba District



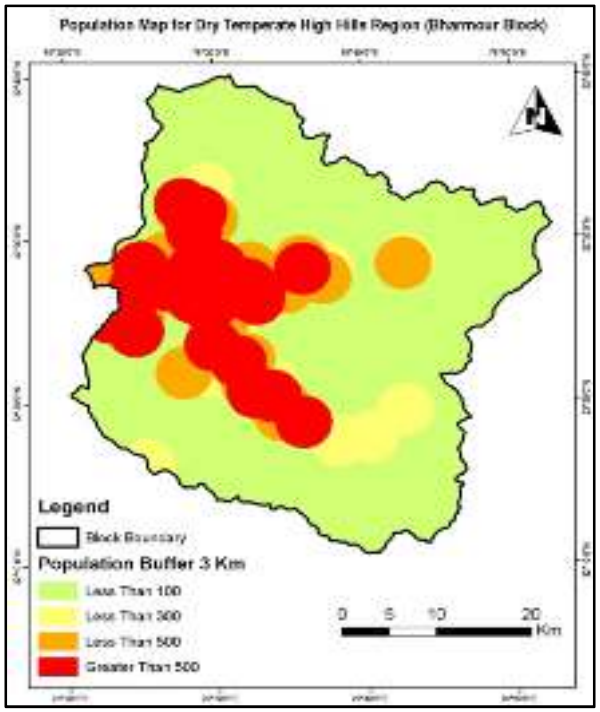
Map 3.28: Drainage/ Drainage/ Water availability map for Bharmour Block of Chamba



Map 3.29: Road network/Accessibility map for Bharmour Block of Chamba District

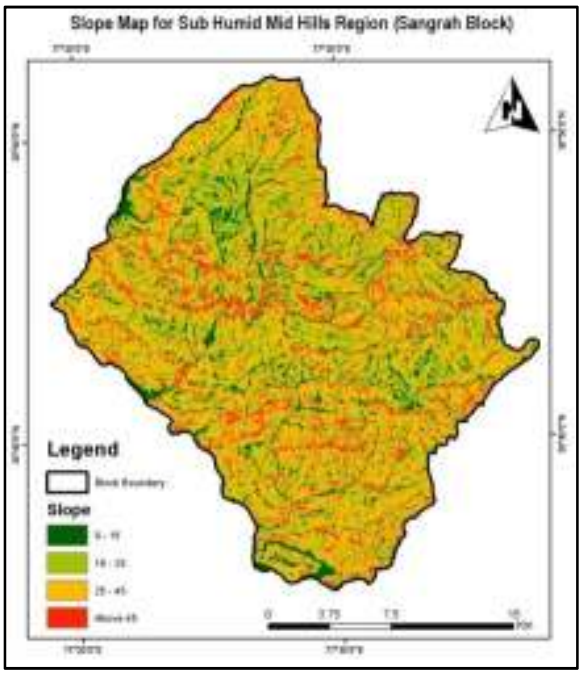


Map 3.30: LULC map for Bharmour Block of Chamba District

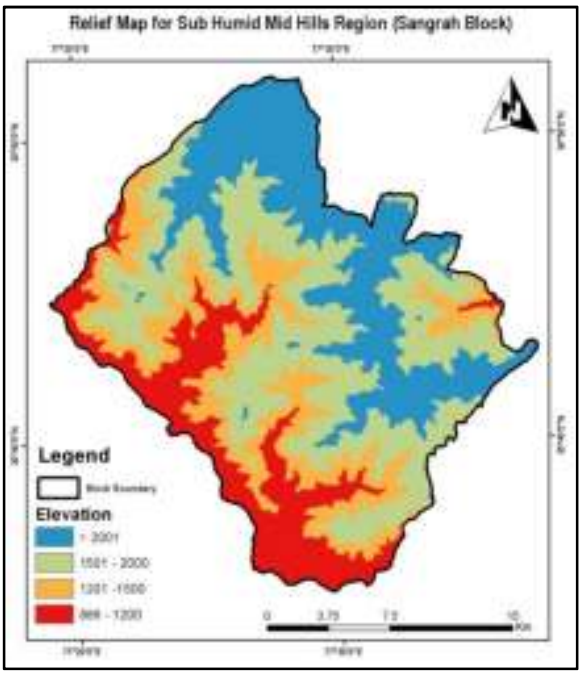


Map 3.31: Population distribution map for Bharmour Block of Chamba District

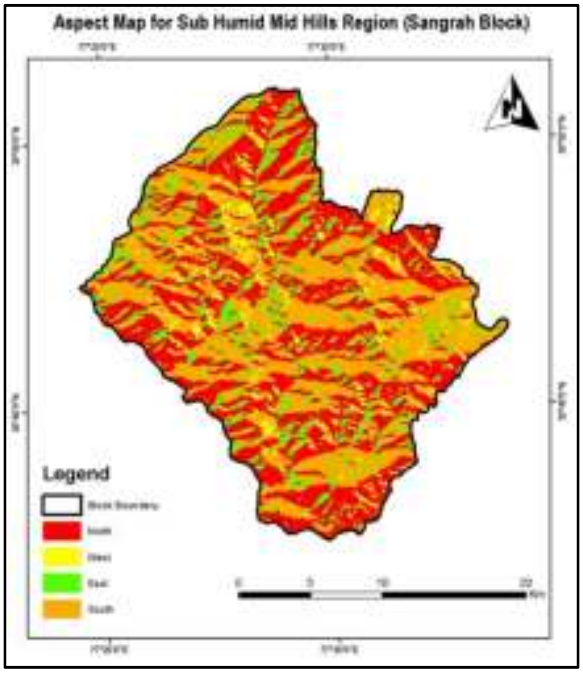
Map 3.25 to 3.31: Maps of different criteria layers for Bharmaur Block of Himachal Pradesh



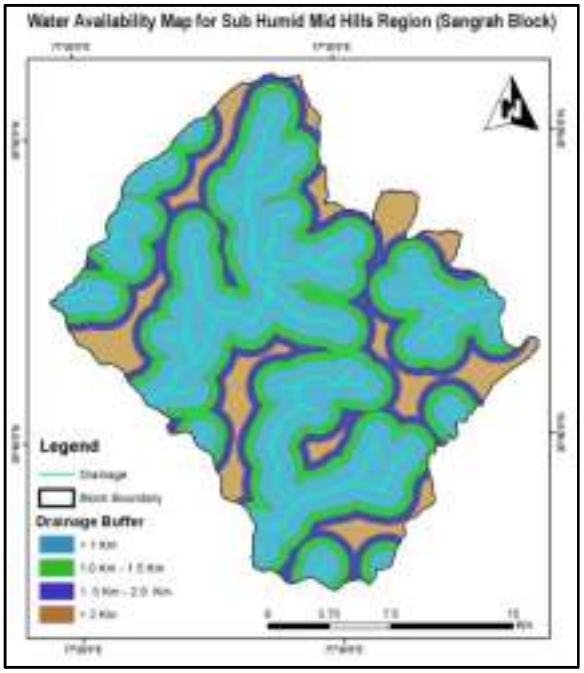
Map 3.32: Slope map for Sangrah Block of Sirmaur District



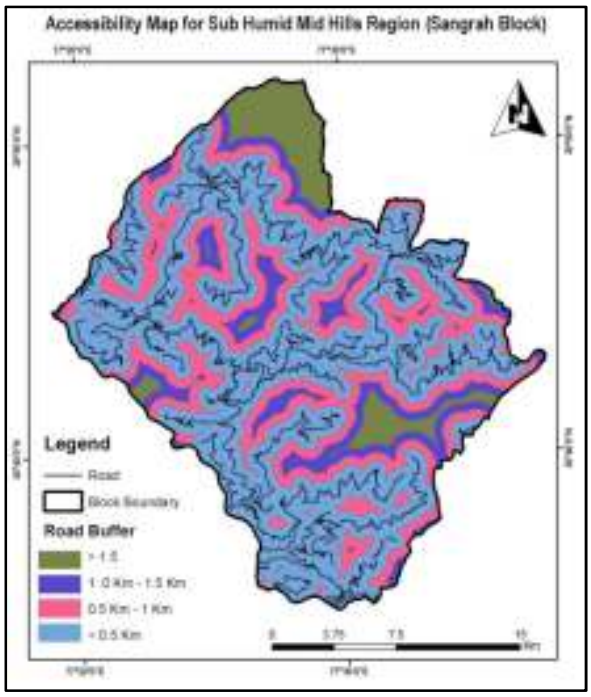
Map 3.33: Relief map for Sangrah Block of Sirmaur District



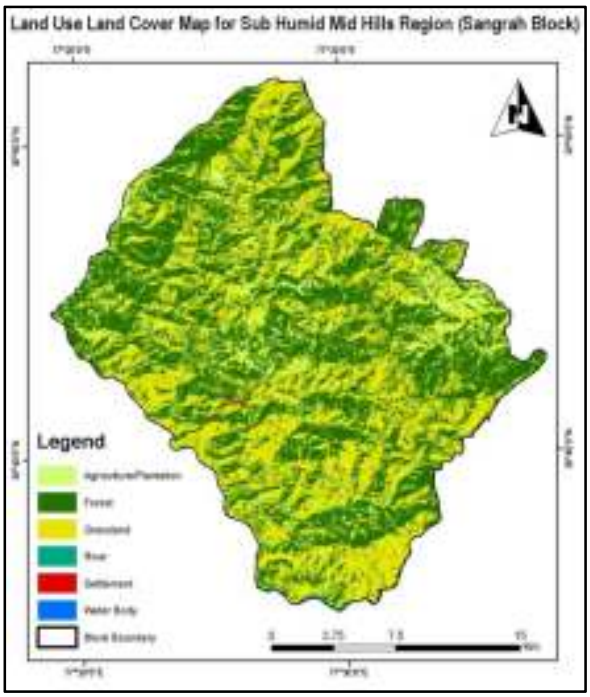
Map 3.34: Aspect map for Sangrah Block of Sirmaur District



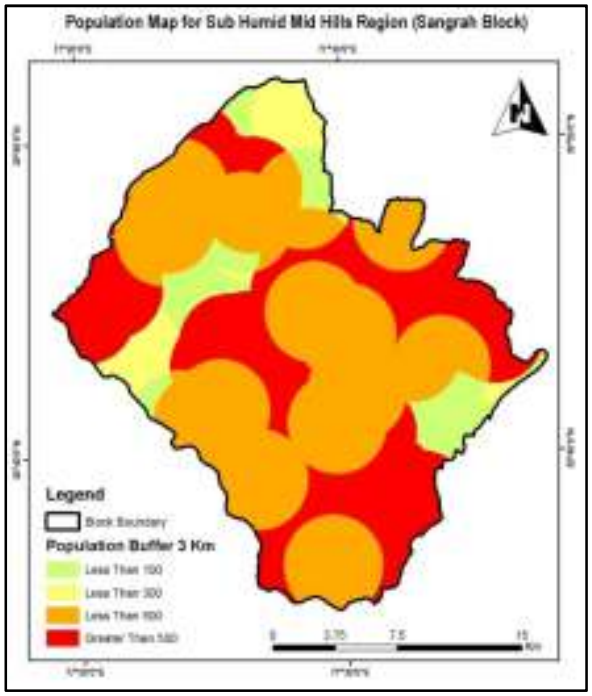
Map 3.35: Drainage/Water avaialability map for Sangrah Block of Sirmaur District



Map 3.36: Road network/Accessibility map for Sangrah Block of Sirmaur District



Map 3.37: LULC map for Sangrah Block of Sirmaur District



Map 3.38: Population distribution map for Sangrah Block of Sirmaur District

Map 3.32 to 3.38: Maps of different criteria layers for Sangrah Block of Himachal Pradesh

3.5 STRATEGIC FRAMEWORK FOR SUSTAINABLE ECOTOURISM DEVELOPMENT USING SWOT TECHNIQUE

In order to determine ecotourism development by using SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis a method related to the analysis of a industry/organization of an area in terms of external (Opportunities and Threats: OT) and internal (strengths, weaknesses: SW) factors called SWOT analysis was used (Fig 3.3). The planning was done for increasing the opportunities and strengths determined according to the analysis results on one hand and on the other, this planning process was created to decrease the weaknesses and threats as well (Yilmaza *et al.,* 2013). Present work explores the possibility of sustainable ecotourism development with regards to judicious utilization of resources and local community involvement.

Fig. 3.3: SWOT layout

In order to obtain SWOT matrix to develop strategies for sustainable development of ecotourism in Himachal Pradesh the procedure adopted is depicted in Fig. 3.4.

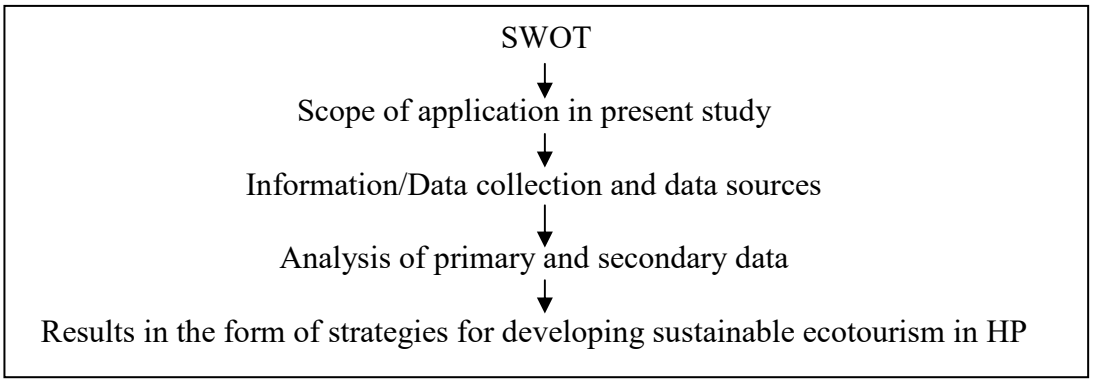


Fig. 3.4: Adopted methodology for SWOT analysis

Both primary and secondary sources of data were used for the analysis. Firstly, primary and secondary data was collected from different sources. The primary data for the purpose has been collected as follows:

1. Survey of the ecotourism sites running in the state and views of the local community
2. Formal and semi-formal interviews with tourists, local people, staff, people and institutions involved in promoting ecotourism industry
3. SWOT Analysis for defining the strategies.

And the secondary data was acquired during different stage of research work from Department of Tourism and Civil Aviation (Government of Himachal Pradesh), ECOSOC, research papers, books, journals and other related literature. Based upon the data/information collected the strengths, weaknesses, opportunities and threats (SWOT) for the ecotourism industry in the region were listed and analyzed in order to obtain the SWOT matrix to identify the required management strategies to develop the sustainable ecotourism in the state.

This objective maps out a way for sustainable growth of the tourism industry in the state using the SWOT (strengths, weaknesses, opportunities and threats) model and a derived matrix out of it. To analyze strategic factors of the tourism industry in the country, internal strengths and weaknesses as well as external opportunities and threats were determined to be followed by development of strategic planning based on the SWOT matrix (Mondal, 2017). The SWOT matrix for this objective was developed on the basis of the following two major criteria:

Analysis of internal factors: Analyze relevant strengths and weaknesses of the ecotourism industry as a result of the internal environment. Strengths and weaknesses constituted factors within the system that either enables or hinder the industry for achieving its goal, respectively (Wasike *et al.,* 2011);

Analysis of external factors: Analyze relevant opportunities and threats presented to the ecotourism industry by the external environment. Opportunities and threats were considered as exogenous factors that either facilitate or limit the industry in attaining its goals, respectively (Wasike *et al.,* 2011).

Finally, a matrix in the form of Fig 3.5 was obtained after thorough analysis of all the primary and secondary information/data collected

SWOT Matrix	**Strength (S)**	**Weakness (W)**
Opportunities (O)	**SO-Strategies** (Use of strength to take advantage of opportunities)	**WO-Strategies** (Initiatives to overcome weakness by taking advantage of Opportunities)
Threats (T)	**ST-Strategies** (Use of strength to avoid threats)	**WT-Strategies** (Minimize weakness and avoid threats)

Fig. 3.5: SWOT matrix layout


Aamod, Shoghi


Nature's Treat, Khalogra


Parks Wood, Aanji


Pine Hills Eco-Camp, Chewa


Nature Camp, Sanawar

Aamod, Dalhousie


Nature Camp, Narkanda


Himalayan Nature Camp, Jalodi

Plate 1: Glimpse of PPP Ecotourism sites in Himachal Pradesh


Ecotourism Site, Kasol


Ecotourism Site, Devidarh

Ecotourism Site, Prashar

Children's Park, Hamirpur

Ecotourism site. Paneo


Ecotourism Site, Holi


Ecotourism Site, Sahoo


Nature Park, Jhiri

Plate 2: Glimpse of Departmental Ecotourism sites in Himachal Pradesh

Chapter-4

RESULTS AND DISCUSSION

The results obtained for the study entitled **"Sustainability assessment and identification of ecotourism sites in Himachal Pradesh"** have been presented and discussed by giving suitable explanations and duly supported by relevant references in this chapter. The results and discussion have been described under following heads and sub-heads:

4.1 Sustainability status of ecotourism activities in Himachal Pradesh

4.1.1 Sustainability indicators and their rating

4.1.2 Carrying capacity of ecotourism sites

4.1.3 Water quality status of ecotourism sites

4.2 Ecotourism potential in Himachal Pradesh

4.3 Strategic framework for sustainable ecotourism development using SWOT technique

4.1.1 SUSTAINABILITY STATUS OF ECOTOURISM ACTIVITIES

The sustainability status of selected ecotourism sites was worked out by considering three criteria i.e. sustainability indicators and their rating, carrying capacity of sites and status of water quality. The results for sustainability status of both PPP and Departmental sites are explained separately and an inter-comparison between both the modes of ecotourism activity was also worked out and is presented below:

4.1.2 Sustainability indicators and their rating

Based on the three core pillars of sustainability i.e. environmental, socio-cultural and economical, the ecotourism activities were assessed for sustainability in various regions of Himachal Pradesh by considering nine key indicators. The results for sustainability status of various sites obtained through survey and interviews are presented as follows:

Energy Consumption

Ranking for energy consumption indicator for selected ecotourism sites studied on the basis of the energy audit done during field visit is described and discussed as follows:

The results presented in Fig. 4.1 showed that the score for energy consumption indicator for PPP sites was in the order of Aamod, Shoghi (5) > Nature Camp, Narkanda (4) = Aamod, Dalhousie (4) > Park Wood, Aanji (3) = Pine Hills Eco-Camp, Chewa (3) > Nature's Treat, Khalogra (2) = Nature Camp, Sanawar (2) > Himalayan Nature Camp, Jalodi (1). The highest rank score at Aamod (Shoghi) was due to the reason that the site completely depends on the conventional source of electricity thus the energy consumption pattern of this site is putting a high impact on this indicator. On the other hand, Nature Camp (Sanawar) and Nature's Treat (Khalogra) were found to have less impact as compared to the former site on this indicator as certain extent of energy requirement on these sites are met using solar panels and some demand is still met by utilizing units from the conventional supply. The two sites have managed to cut out major expenses, hence putting little impact on the energy consumption indicator. Himalayan Nature Camp (Jalodi) was found to register the least score, because at the site, electricity demand is met using the renewable source of energy, solar panels are instslled at the site for generating solar power. The use of solar energy at rest of the sites is either very less or was not present at all.

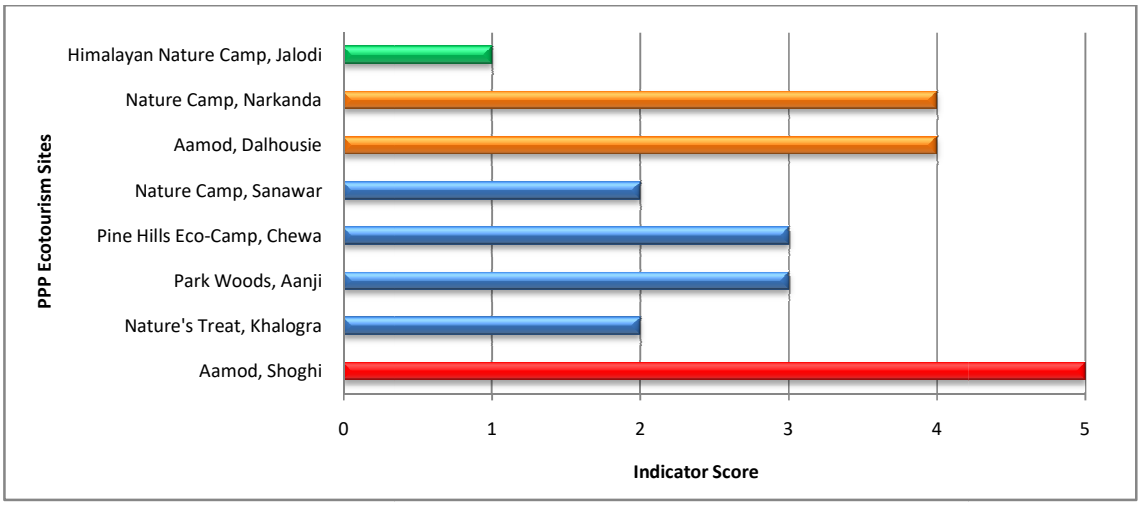


Fig. 4.1: Energy consumption indicator score for PPP ecotourism sites

In case of Departmental sites energy consumption pattern was found in the order of Nature Park, Jhiri (5) > Ecotourism site, Paneo (4) = Ecotourism site, Sahoo (4) = Ecotourism site, Holi (4) = Ecotourism site, Prashar (4) = Ecotourism site, Kasol (4) > Ecotourism site, Devidarh (3) > Children's Park, Hamirpur (2) as depicted in Fig. 4.2. Highest rank for Nature Park at Jhiri can be attributed to the high use of electricity due to diverse activities going on at the sites including two restaurants and the accommodation facilities as well. Following

Nature Park (Jhiri) are Ecotourism site Paneo, Sahoo, Holi, Prashar and Kasol that were ranked equally in terms of energy consumption and demand. These sites have energy requirement only for the accommodation facilities and no other electricity based facility is present. At Ecotourism site (Devidarh) though the energy demand in the tents is met by solar energy but conventional electric appliances are avalaible in the rooms. The Departmental site with least energy consumption is Children's Park (Hamirpur), where the facilities avalailable do not require electricity for functioning like swings, walking trails, etc., also the number of accommodation facilities available on site was very less as compared to other sites.

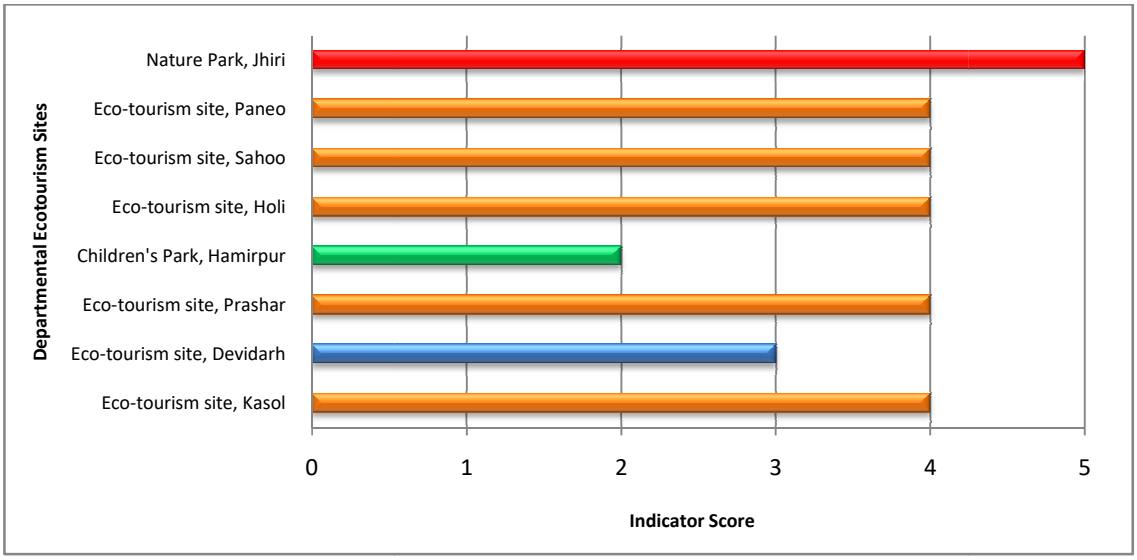


Fig. 4.2: Energy consumption indicator score for Departmental ecotourism sites

Data depicted in Fig. 4.3 indicated that total indicator score for PPP ecotourism sites us 24 whereas it is 30 for the Departmental sites. Higher score at the later sites can be attributed to the reason that almost all of the sites are completely dependent on conventional electricity supply to meet energy demand. During survey it was also observed that at most of the PPP sites, the energy requirement is met by solar power to quite an extent as solar panels are installed for solar energy. Also, the managers at these sites have implemented strict rules for ensuring more judicious use of electricity than the Departmental sites. Accommodation facilities at PPP sites are mostly in the form of tents and cottages and fewer electric appliances are placed in these facilities further reducing the electricity consumption, but at Departmental sites mostly concrete structure with all appliances are present.

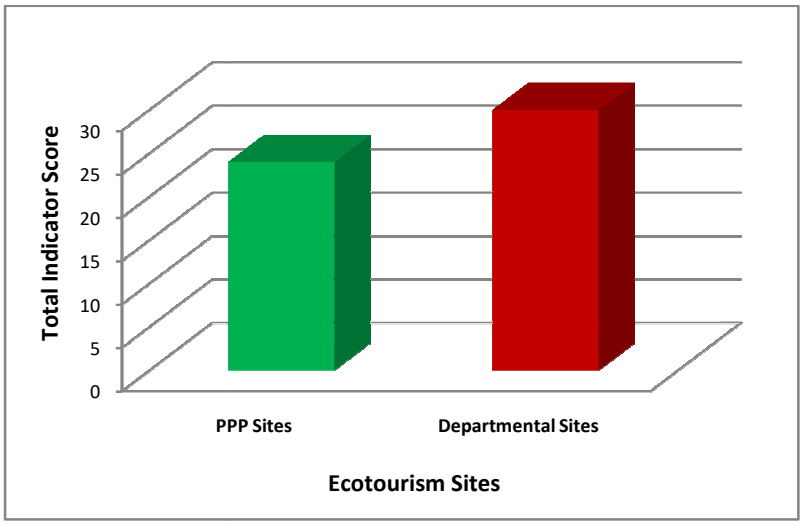


Fig. 4.3: Site wise total score for energy consumption indicator

Waste Management

Waste management indicator was ranked on the basis of amount and type of waste generated by the ecotourism sites and the method of waste management and disposal followed. In this regard, as per the data depicted in Fig 4.4 it was found that the score for waste mangement indicator at PPP sites was in the order of Nature's Treat, Khalogra (5) > Himalayan Nature Camp, Jalodi (4) = Nature Camp, Sanawar (4) > Aamod, Shoghi (3) > Nature Camp, Narkanda (2) = Aamod, Dalhousie (2) = Pine Hills Eco-Camp, Chewa (2) = Park Woods, Aanji (2). The results can be attributed to the reason that, PPP sites are dependant on the nearby Municipal Corporation for disposing the waste, as all the sites fall near or under the municipal area. Nature's Treat (Khalogra) and Nature Camp (Sanawar) however, did not have any norm of waste segregation and were entirely dependant on the MCDs for waste disposal, hence putting a high impact on the waste management indicator. Himalayan Nature Camp (Jalodi) on the other hand, dry and wet waste was segregated and plastic waste was reused for purposes like bench making but the other waste is dumped in the pits made for the purpose in the nearby forest area. Though at some sites the dry and wet waste is segregated; composting of wet waste is done at the site itself and the dry waste is sent to Municipal Corporation Dumps (MCDs). At Nature Camp (Narkanda), Aamod (Dalhousie), Pine Hills Eco-Camp (Chewa) and Park Woods (Aanji) and Aamod (Shoghi) the site managers gave away their dry waste to the MCDs and also had composting pits for recycling their kitchen and other organic waste.

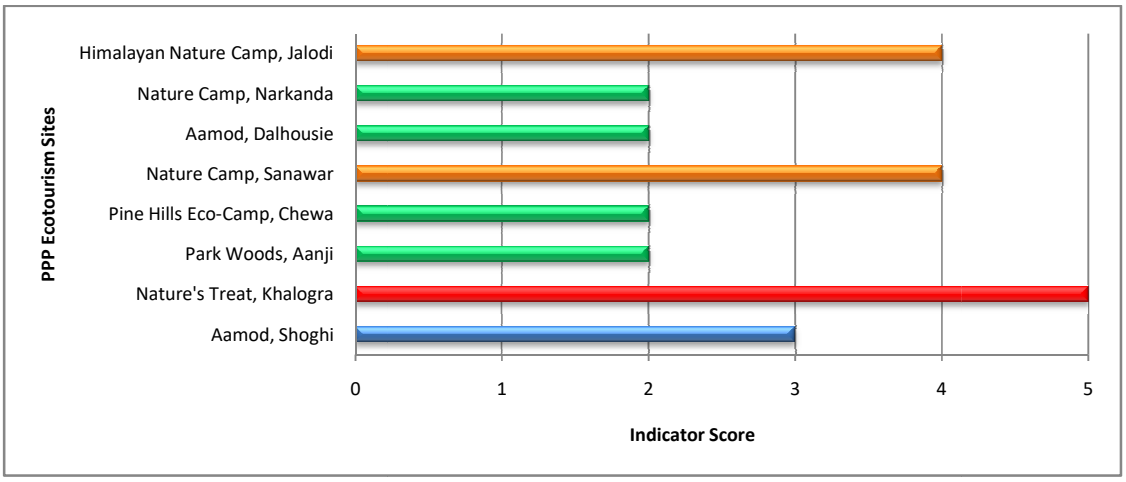


Fig. 4.4: Waste management indicator score for PPP ecotourism sites

In case of Departmental sites, the rank for waste management indicator was in the order of Children's Park, Hamirpur (5) > Nature Park, Jhiri (4) = Ecotourism site, Paneo (4) = Ecotourism site, Holi (4) = Ecotourism site, Devidarh (4) > Ecotourism site, Sahoo (3) > Ecotourism site, Prashar (3) > Ecotourism site, Kasol (3) as depicted in Fig. 4.5. The results can be attributed to the reason that at Children's Park (Hamirpur) the waste is not managed regularly, all types of waste was found scattered all over the park at the time of survey and the respondents also added that the park is not cleaned regularly, thus giving the site a higher rank than others, and putting a higher impact on the waste management indicator. Nature Park (Jhiri), Ecotourism site at Paneo, Holi, and Devidarh are located far from any MCD area so the waste is disposed at site itself, waste is simply dumped in the pits without segragation. But Ecotourism site at Sahoo, Prashar and Kasol segregates the waste and use pits for disposal of organic waste which degrades over time.

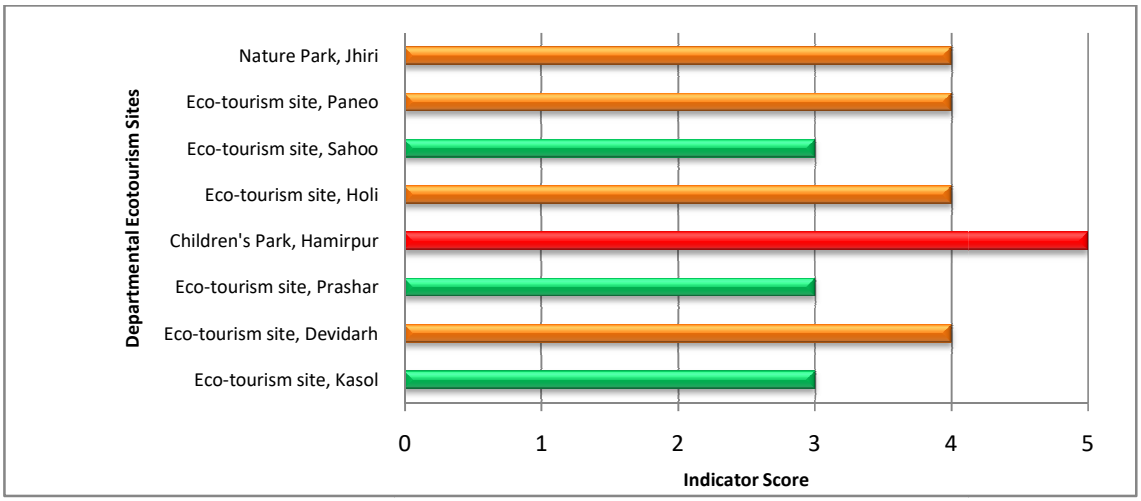


Fig. 4.5: Waste management indicator score for Departmental ecotourism sites

Comparing both modes of ecotourism simultaneously for waste management indicator indicated that Departmental sites with a total indicator score of 30 are less sustainable than the PPP sites with a score of 24 for this indicator as presented in Fig. 4.6. This can be attributed to various reasons, viz. some of the Departmental sites lie in the forest area far from any municipal boundary like Ecotourism site at Devidarh, Holi and Paneo that puts pressure on the site managers to dispose and manage waste on site itself, even at certain sites the waste was simply dumped in the pits made for the purpose. However, PPP sites are situated within or near the municipal area facilitating waste disposal and also the site managers are following scientific waste management methods to some extend including waste segregation and composting.

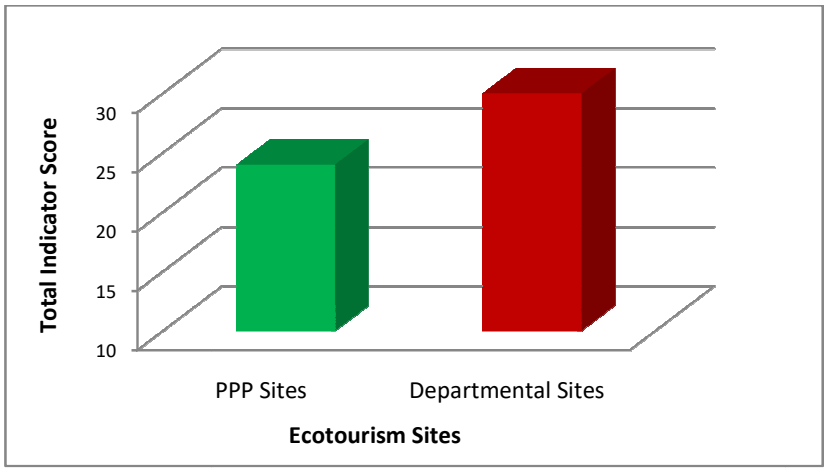


Fig. 4.6: Site wise total score for waste management indicator

Bio-capacity

For ranking the bio-capacity indicator, the natural resource base available in the form of open area for setting tents and sports activities; sparse forest area and slopy region for walking/cycling trails; water availability and scenic areas, etc, that can be used for ecotourism purpose were considered. On the basis of assessment of PPP ecotourism sites for bio-capacity as depicted in Fig. 4.7, the highest rank was scored by Nature Camp, Narkanda (3) = Nature Camp, Sanawar (3) = Nature's treat, Khalogra (3) followed by Aamod, Dalhousie (2) = Pine Hill Eco-Camp, Chewa (2) = Park Wood, Aanji (2) = Aamod, Shoghi (2) that were equally ranked for biocapacity. Himalayan Nature Camp (Jalodi) was however found to rank least (1) for bio-capacity indicator. Certain sites were ranked lesser than the others because more area and forest including open patches are available for ecotourism activities on the sites. Aamod

(Dalhousie) and few other sites have taken certain initiatives like raising plantations and medicinal plants nursery to enhance its bio-capacity.

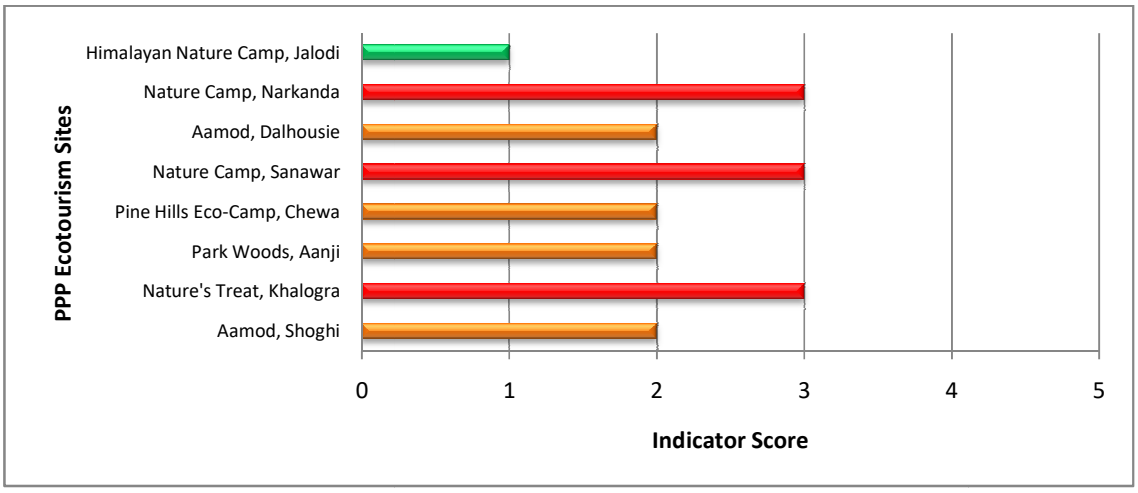


Fig. 4.7: Bio-capacity indicator score for PPP ecotourism sites

In case of Departmental ecotourism activity as depicted in Fig. 4.8, the sites were found to follow the order, Ecotourism site, Sahoo (3) = Ecotourism site, Paneo (3) followed by Nature Park, Jhiri (2) = Ecotourism site, Holi (2) = Children's park, Hamirpur (2) = Ecotourism site Devidarh (2) and Ecotourism site Kasol (2) > Ecotourism site, Parashar (1). The sites scoring higher depicted the availability of lesser area and resources for ecotourism purpose than the others. The site at Prashar was ranked the least as it is located within 500m of the famous Prashar lake in addition to the ample area available for setting tents and other facilties further sustaining the ecotourism activities.

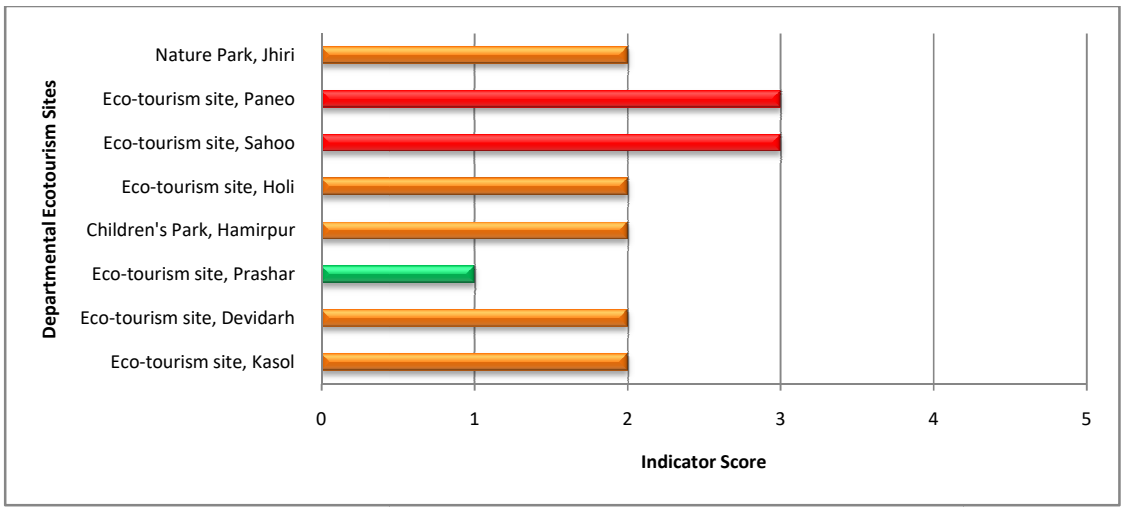


Fig. 4.8: Bio-capacity indicator score for Departmental ecotourism sites

While comparing both the modes of ecotourism sites for biocapacity Departmental sites were found to have a little edge with a total indicator score of 17 as can be seen from Fig. 4.9 than the PPP ecotourism sites with a score of 18 for this indicator. Both were ranked quite low depicting sufficent resources for supporting the ecotourism activity. Two modes of the activity attained the highest rank of 3 fo any site which indicates the avaialbility of ample area and resources in the region for ecotourism purposes. However, Some sites scored higher than the others sites because of a little less area and resource availability. For instance at Nature Camp (Narkanda), though the area demarcated for ecotourism purpose is large but because of the presence of very steep slopes, highly dense forest and road dividing the site, the indicator for the site was given a higher rank. The presence of all these features restricts the use of resources for ecotourism purpose. At the same time at Himalayan Nature Camp (Jalodi) a PPP site (Fig. 4.7) and Ecotourism site (Parashar) a Departmental site (Fig. 4.8), a large proportion of the surrounding area is grassland with sparsely present tress, thus the area has high potential to be brought under varied ecotourism activities, like walking/cycling trails, setting of adventure activities, etc.

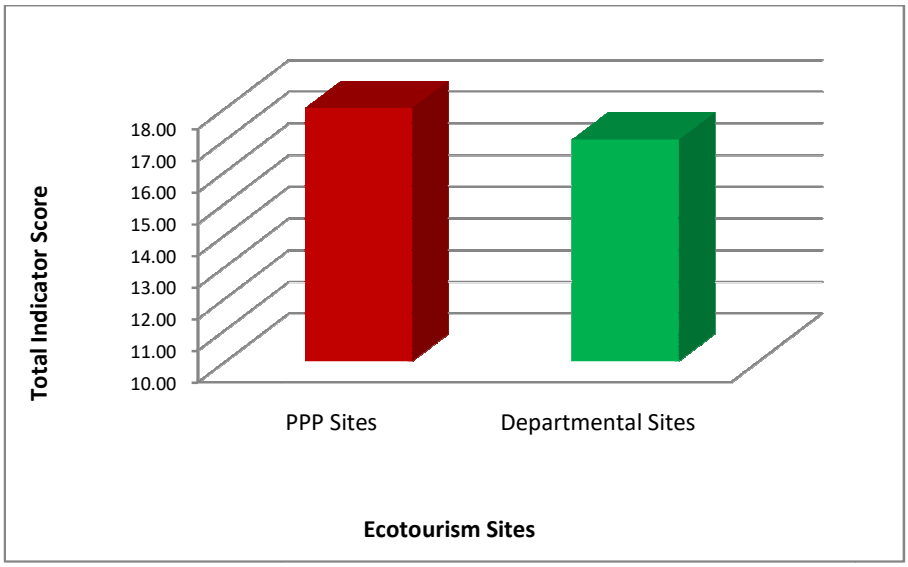


Fig. 4.9: Site wise total score for bio-capacity indicator

Building Material

For ranking this indicator the type of material and extent of its use for developing the site especially the accommodation facilities was taken into account. From Fig 4.10 it can be concluded that the order of score for building material indicator is Aamod, Shoghi (5) > Park Woods, Aanji (3) > Aamod, Dalhousie (2) = Nature's Treat, Khalogra (2) > Himalayan

Nature Camp, Jalodi (1) > Nature Camp, Narkanda (1) = Nature Camp, Sanawar (1) = and Pine Hills Eco-Camp, Chewa (1). The results obtained can be attributed to the fact that at most of the PPP sites including Himalayan Nature Camp (Jalodi), Nature Camp (Narkanda), Nature Camp (Sanawar), and Pine Hills Eco-Camp (Chewa) the accommodation facilities were either tents or bamboo cottages and the walking paths were simply stone laid and not cemented putting less impact on building material indicator. Whereas, at Aamod (Shoghi) concrete structures are available giving this site a higher rank than others and making it less sustainable in terms of building material used. A total of 23 cottages which were differentiated into deluxe cottages, super deluxe cottages, family cottages and family deluxe cottages are present at Aamod (Shoghi). At PPP sites like Park Woods (Aanji), Aamod (Dalhousie) and Nature's Treat (Khalogra) a mix of concrete structure and wooden structures are present.

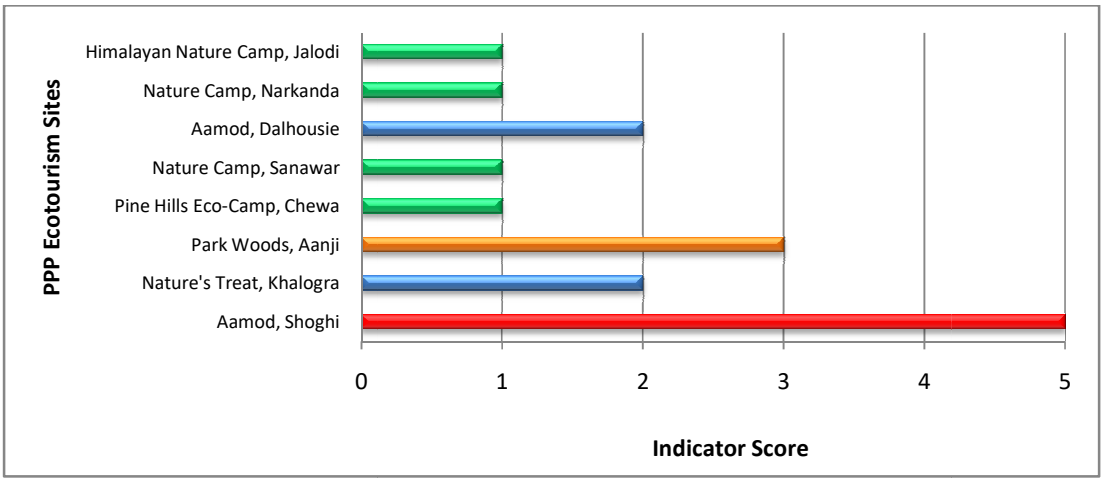


Fig. 4.10: Building material indicator score for PPP ecotourism sites

Fig. 4.11 shows the order followed by the Departmental sites and is as follows, Nature Park, Jhiri (4) = Ecotourism site, Sahoo (4) > Ecotourism site Paneo (3) = Ecotourism site, Holi (3) = Ecotourism site, Prashar (3) = Ecotourism site, Devidarh (3) = Ecotourism site, Kasol (3) > Children's Park Hamirpur (2). All the sites under this mode however were ranked higher due to the use and availability of mostly concrete structures for accommodation. At few sites i.e. Ecotourism site (Paneo), Sahoo, Holi, Prashar, Devidarh and Kasol, however accommodation in the form of tents was also available in addition to the cemented rooms. Nature Park (Jhiri) was found to be least sustainable in terms of building material indicator, as a lot of concrete structures are present at site including restaurants, walking trails,

accommodation area, etc. Children's Park (Hamirpur) scored less, as minimal quantity of concrete is used for developing the site.

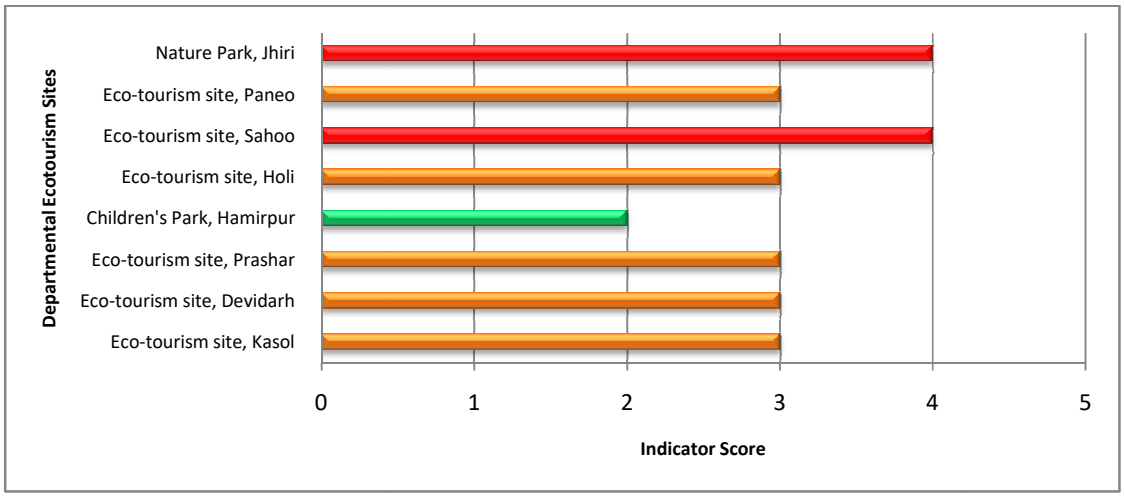


Fig. 4.11: Building material indicator score for Departmental ecotourism sites

Out of the two types of ecotourism sites, PPP with a total indicator score of 16 were found to impact the building material indicator less than the Departmental sites with total indicator score 25 as depicted in Fig. 4.12. The results can be attributed to the fact that because at almost all of PPP sites, accommodation facilities and other structures are made out of nature friendly material like bamboo, wood and simple tents were placed. However, at most of the Departmental sites maximum accommodation facilities were concrete structures.

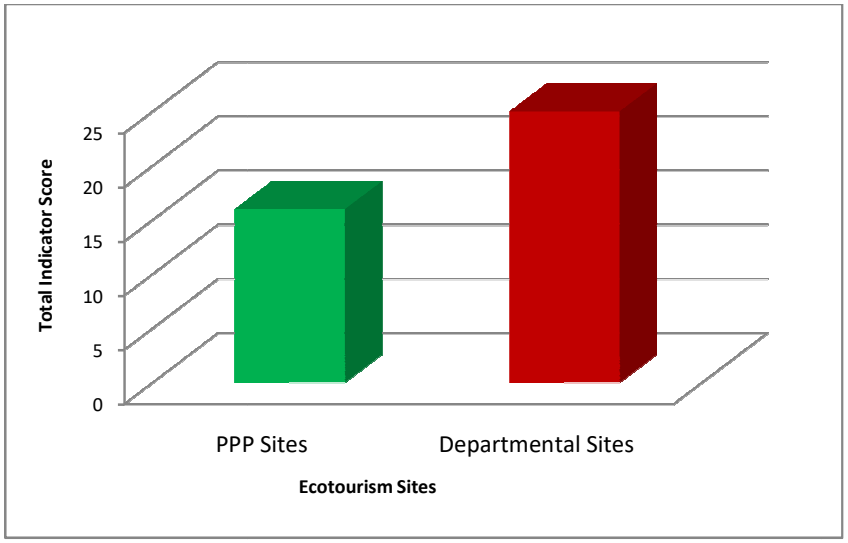


Fig. 4.12: Site wise total score for building material indicator

Potable water

As depicted in Fig. 4.13 the maximum demand and consumption of water was noted in the following order Aamod, Shoghi (5) which was followed by Himalayan Nature Camp, Jalodi (4), Aamod, Dalhousie (4), Park Woods, Aanji (4) > Nature Camp, Narkanda (3) = Pine Hills Eco-Camp, Chewa (3), Nature Camp, Sanawar (3) > Nature's Treat, Khalogra (2). There being no large sources of water nearby the PPP ecotourism sites, all of the sites are mainly dependent on water tankers for meeting large amount of water demand. The number of tankers utilised per day was used to evaluate the impact of this indicator. Therefore, the indicator was highly impacted at Aamod (Shoghi) and comparatively lower at other sites. Nature's Treat (Khalogra) however was found to score least because of less dependence on water tankers.

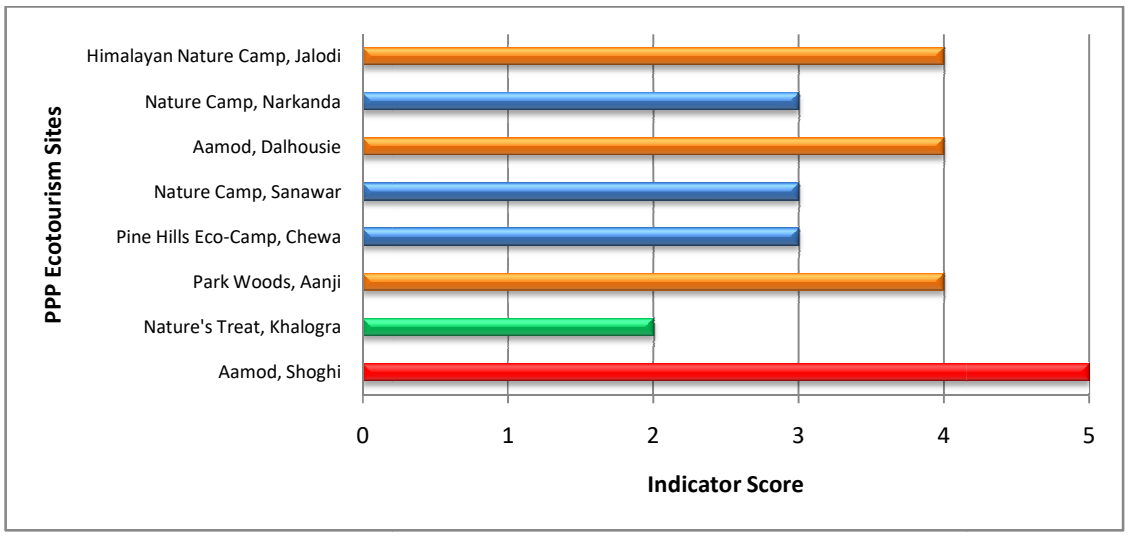


Fig. 4.13: Potable water demand indicator score for PPP ecotourism sites

For Departmental sites the order followed for potable water demand indicator is Ecotourism site, Paneo (4) > Nature Park, (Jhiri) = Ecotourism site, Sahoo (3) = Ecotourism site, Holi (3) = Children's Park, Hamirpur (3) > Ecotourism site, Prashar (2) > Ecotourism site, Devidarh (1) = Ecotourism site, Kasol (1) as depicted in Fig 4.14. Except for Ecotourism site at Kasol and Devidarh, where the nearby water sources are harvested for meeting the water requirement, rest of the Departmental sites are highly dependent on IPH water supply to fulfill their water requirements. However, at certain sites like Nature Park (Jhiri) and Ecotourism site at Sahoo and Holi, the State Forest Department has managed to build water storage tank for the ecotourism site itself, thus lowering the impact on the water

demand indicator. Children's Park (Hamirpur) on the other hand was ranked lower because of its low water requirement as very few accommodation facilities are available on site and no other facility present on site requires water. Ecotourism site (Prashar) however, was partially dependent on IPH supply and a significant amount of water demand was met by water harvested from the nearby water source. Ecotourism site (Paneo) was least sustainable in terms of water demand because not only the site is completely dependent on IPH water supply but also because of high water demand pertaining to more number of accommodation facilities and more tourist inflow.

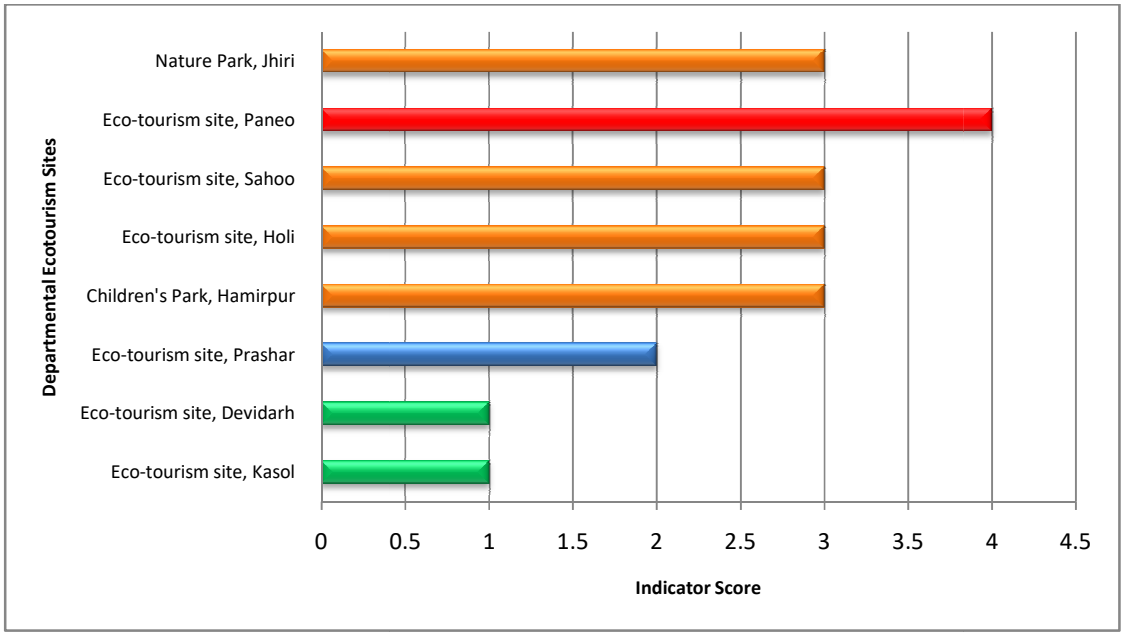


Fig. 4.14: Potable water demand indicator score for Departmental ecotourism sites

Comparing both the modes for this indicator it was observed that Departmental sites scored less i.e. 20 while the PPP sites attained a total indicator score of 28 for potable water demand indicator (Fig. 4.15). The results can be attributed to the fact that the PPP sites have more tourist inflow than the Departmental sites thus the former sites have more water requirement which these sites are unable to fulfill from the conventional water supply. At many Departmental sites some nearby source of water was available which has been managed by the staff to meet the water requirement. None of the sites operating on both the modes however was found to have any water harvesting structures or watershed management system for harvesting water for fulfilling the requirement.

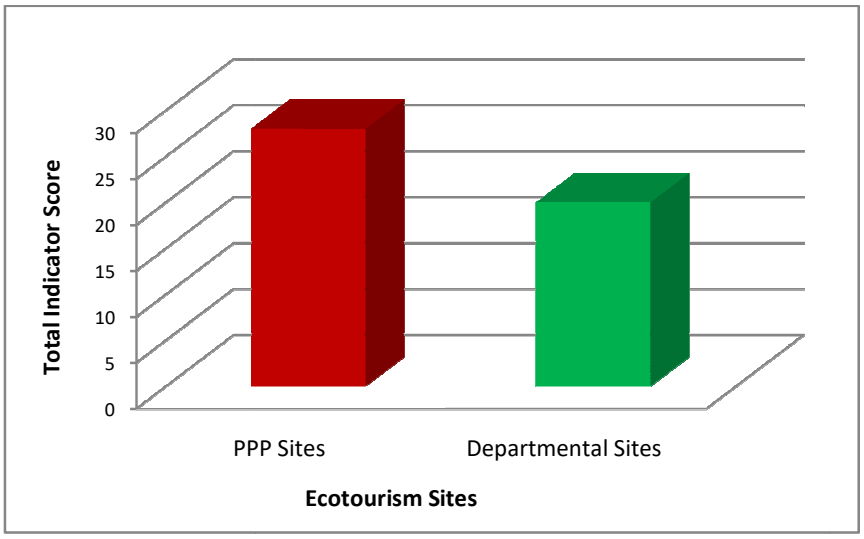


Fig. 4.15: Site wise total score for potable water demand indicator

Tourist facilitation

Various recreational activities and other facilities like games, sports, engagement with locals, etc, for tourists facilitation and entertainment were analysed at selected ecotourism sites for ranking this indicator, as tourist satisfaction is highly important for the sustenance of any ecotourism venture. For the PPP activities the sites followed the order Himalayan Nature Park, Jalodi (4) = Nature Park, Narkanda (4) > Nature Camp, Sanawar (3) = Parks Wood, Aanji (3) = Nature's Treat, Khalogra (3) > Aamod, Dalhousie (2) = Pine Hill Eco-Camp, Chewa (2) > Aamod Shoghi (1) as depicted in Fig. 4.16. Aamod (Shoghi) scored the lowest for the indicator because of variety of activities being offered to the tourists consisting of Burma bridge, rope bridge walk, commando net, rock climbing, rappelling, nature walk, animal spotting, orienteering, mountain biking and trust fall. Next to Aamod (Shoghi) are Aamod (Dalhousie) and Pine Hill Eco- Camp (Chewa) that provided facilities like mountain cycling, rock climbing, cooking in wild, hurdle activities, flying fox, zip lining, tribal archery, commando bridge, teeter wobble, burma bridge, languor walk, bonfire and trekking. In addition, Aamod (Dalhousie) has initiated the plantations of local species by tourists name thus creating awareness amongst the tourists for environment conservation through plantation, and indoor gaming area. Nature Camp (Sanawar), Parks Wood (Aanji) and Nature's Treat (Khalogra) are next in decreasing order of sustainability in terms of tourist facilitation offering activities like trekking, bamboo bridge, commando crawl, barrel crawl, navigational trek, pole balancing, burma bridge, zip lining, flying fox, valley crossing, archery, hanging bamboo, commando net, monkey crawl, australian trolley and tug of war.

However, two sites Himalayan Nature Park (Jalodi) and Nature Park (Narkanda) have lesser facilities like trekking, bone fire, nature walk, in comparison to others thus becoming least sustainable in this category, but are planning to further improve the equipment for tourists.

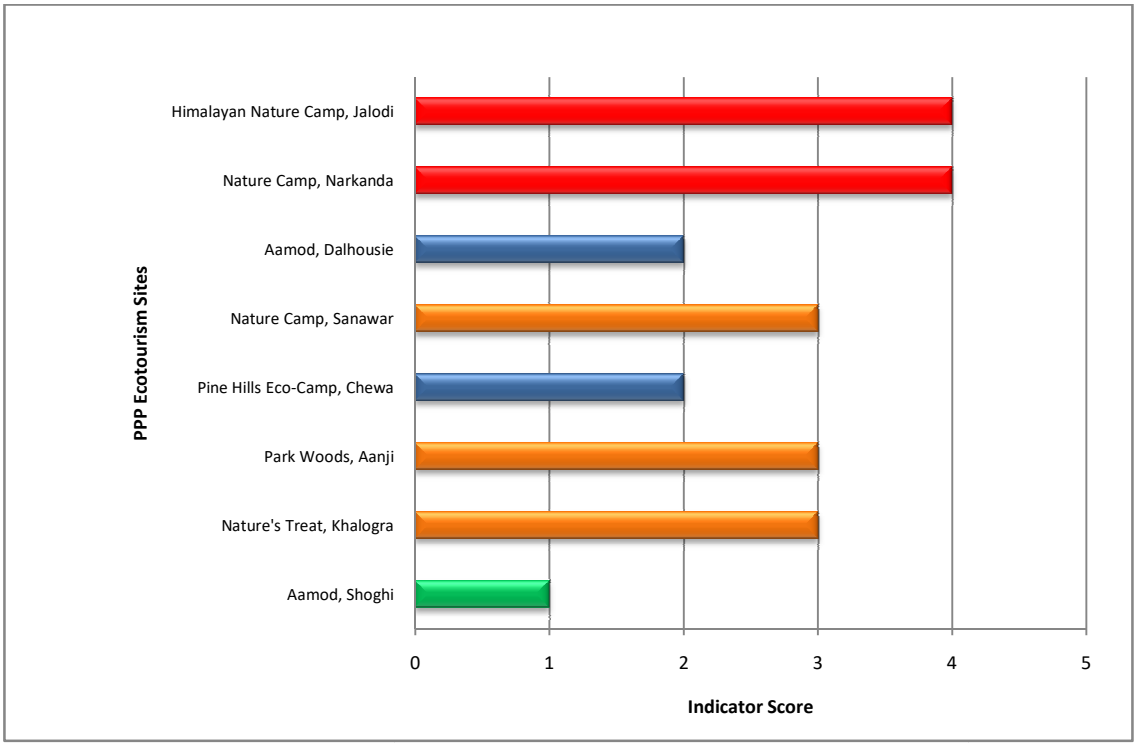


Fig. 4.16: Tourist facilitation indicator score for PPP ecotourism sites

Departmental sites on the other hand followed the order (Fig. 4.17), Ecotourism site Paneo (4) and Ecotourism Site Devidarh (4) > Ecotourism site, Sahoo (3) = Ecotourism site, Holi = Children's Park, Hamirpur (3) = Ecotourism site, Prashar (3) > Ecotourism site Kasol (3) > Nature Park Jhiri (2). The sites running on this mode were not providing much activity or facilities to the tourists except for Nature Park (Jhiri) where activities like river rafting, properly managed park; walking trails were available to the visitors. Sites including Ecotourism site (Sahoo), Holi, Children's Park (Hamirpur), and Ecotourism site (Prashar) provided limited facilities to the tourists including nature walk, open space or a small park for recreation. Ecotourism site (Kasol) however had a natural hot water bath facility for visitors and a forest nursery as well. On the other hand Ecotourism site (Paneo) and Ecotourism Site (Devidarh) did not have any recreational facilities for the tourists and only provided lodging area, putting high impact on the indicator and making them less sustainable in terms of tourist facilitation.

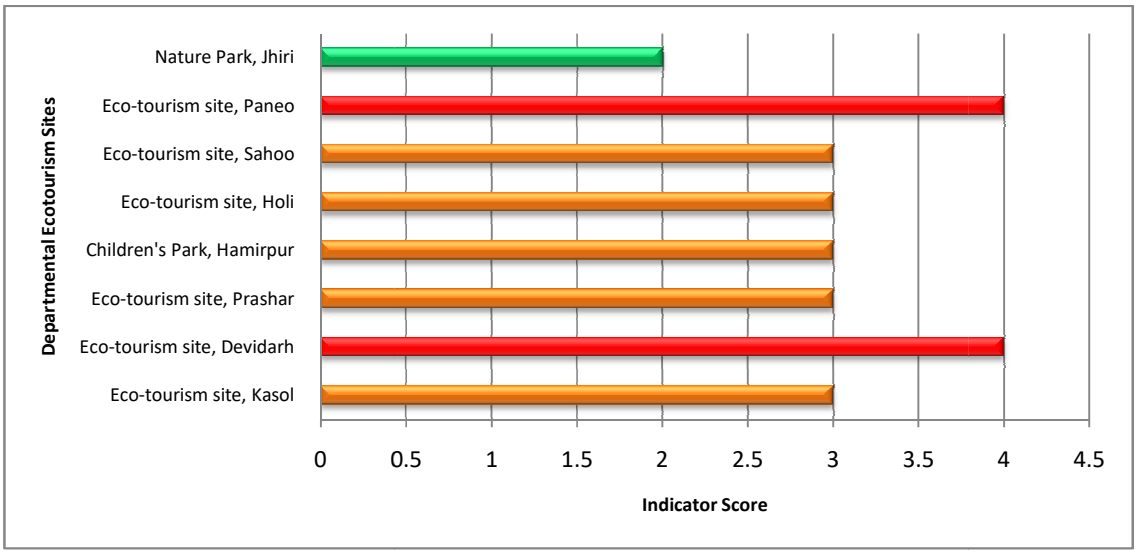


Fig. 4.17: Tourist facilitation indicator score for Departmental ecotourism sites

Comparing PPP and Departmental ecotourism sites for tourist facilitation indicator the former sites were ranked lower (22) than the later sites that scores 25 as depicted in Fig. 4.18. The rank obtained by both types of sites revealed that PPP sites were offering more facilities for tourist engagement than the Departmental ecotourism sites. The results can be attributed to the availability of more staff on the PPP sites and also because the managers of these sites are running the activity efficiently for profit purpose as well.

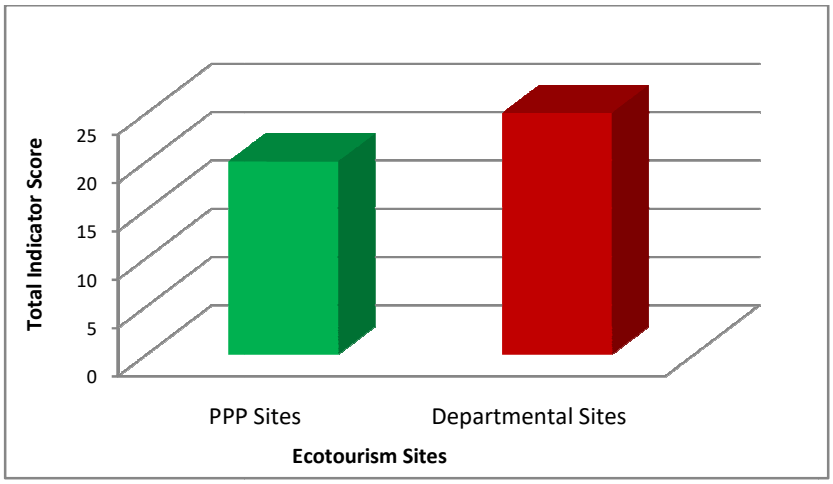


Fig. 4.18: Site wise total score for tourist facilitation indicator

Cost to users

In order to rank the sites for this indicator, the cost per night as well as for various other activities on site was taken into account. As presented in Fig. 4.19, the sites on PPP

mode followed the order Aamod, Dalhousie (4) = Aamod, Shoghi (4) > Nature Camp, Narkanda (3) = Nature Camp, Sanawar (3) = Pine Hills Eco-Camp, Chewa (3) = Parks Wood, Aanji (3) > Himalayan Nature Camp, Jalodi (2) = Nature's Treat, Khalogra (2). Aamod (Shoghi) and Aamod (Dalhousie) were ranked the highest for cost to users indicator on account of high cost of boarding, lodging and other facilities. Nature Camp (Narkanda), Nature Camp (Sanawar), Pine Hills Eco-Camp (Chewa) and Parks Wood (Aanji) however were more economical to the tourists in comparison to the former two sites. Himalayan Nature Camp (Jalodi) and Nature's Treat (Khalogra) were ranked lowest for this indicator because of reasonable cost of stay at these sites.

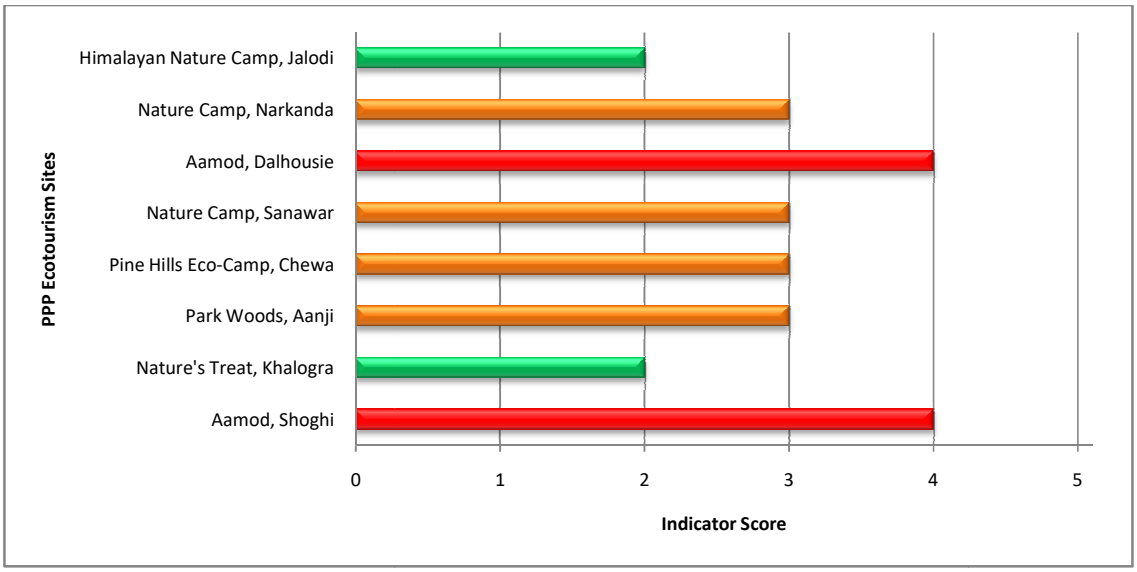


Fig. 4.19: Cost to users indicator score for PPP ecotourism sites

In case of Departmental sites as depicted in Fig. 4.20, the following order was observed Nature Park Jhiri (3) = Ecotourism Site Prashar (3) = Ecotourism Site, Kasol (3) > Ecotourism site, Paneo (2), Ecotourism site, Sahoo (2) = Ecotourism site, Holi (2) = Ecotourism site, Devidarh (2) > Children's Park, Hamirpur (1). Certain sites like Nature Park (Jhiri), Ecotourism Site at Prashar and Kasol were ranked higher than other sites because of higher cost than the others, making them less cost effective. Ecotourism site (Paneo), Sahoo, Holi and Devidarh were slightly less costly than the former sites because of the variety of accommodation facilities available. Children's Park (Hamirpur) on the other hand was ranked lowest and was found to be cost effective because of the very nominal fee being charged from the visitors for entry and stay.

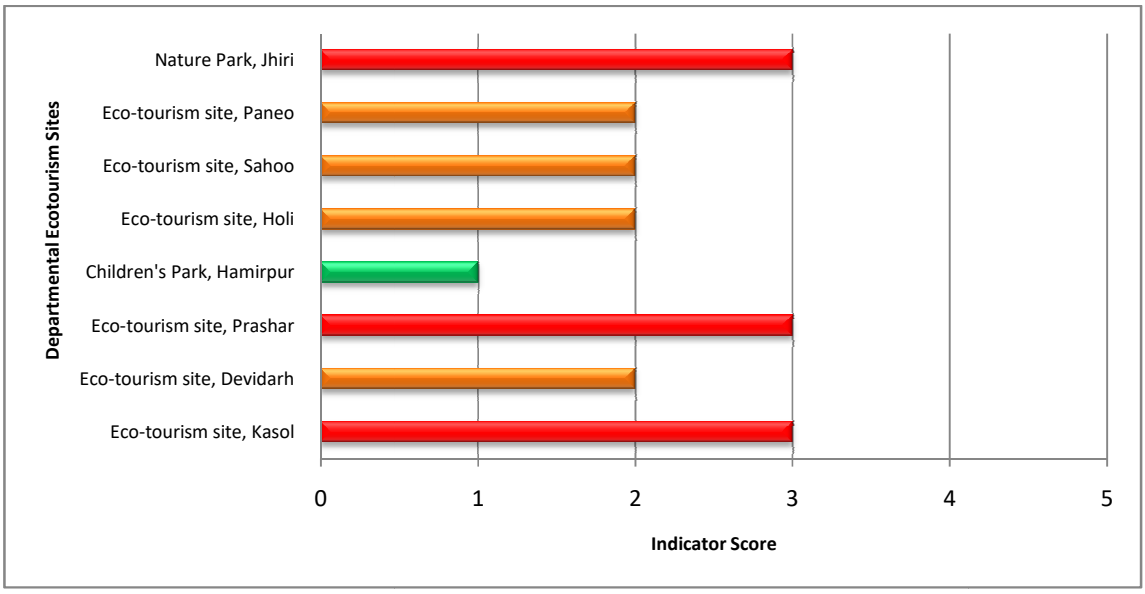


Fig. 4.20: Cost to users indicator score for Departmental ecotourism sites

In terms of cost to users as indicated in Fig. 4.21 PPP sites with a total indicator score of 24 were found to be less sustainable less than the Departmental sites with a score of 19 for this indicator. The results are attributed to the fact that the PPP sites are costlier than the Departmental sites as more facilities are available and also better management in terms of managerial staff employed at the former sites. These sites are managed individually for profit generation in addition to nature conservation whereas, Departmental ecotourism sites are more cost-effective as the fee and other charges for the sites are controlled by the Ecotourism Wing of the State Forest Department and online bookings are done through the official website, thus making sure reasonable price for tourists. Also, the facilities and other activities are very minimal at these sites.

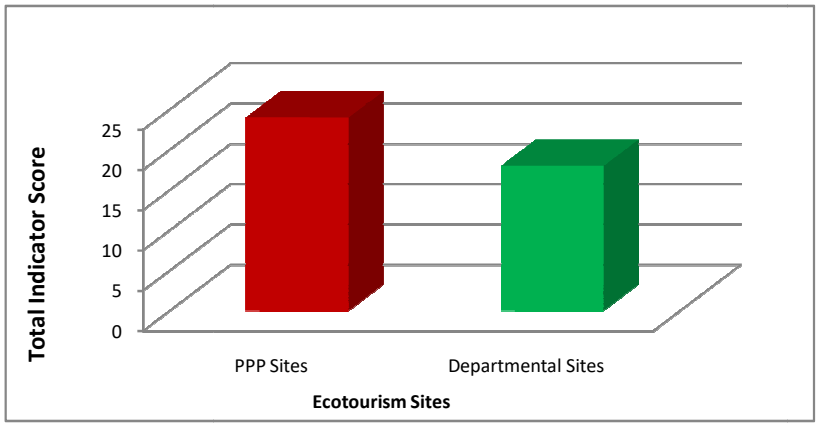


Fig. 4.21: Site wise total score for cost to user's indicator

Local employment

The number of local people employed at any ecotourism site, post offered and salary paid to them were the points of consideration while ranking this indicator. The sites functioning on PPP mode were found to follow the order (Fig. 4.22) Aamod, Shoghi (4) > Nature Camp, Narkanda (3) > Himalayan Nature Camp, Jalodi (2) = Aamod, Dalhousie (2) > Nature Camp Sanawar (1), Pine Hills Eco- Camp Chewa (1), Park Woods, Aanji (1) and Nature's Treat, Khalogra (1). Majority of the PPP sites have employed staff from the nearby communities and are providing jobs to them. Nature Camp (Sanawar), Pine Hills Eco- Camp (Chewa), Park Woods (Aanji) and Nature's Treat (Khalogra), have 100 per cent staff from the nearby villages and thus were scored to be the most sustainable sites. Aamod (Shoghi) and Nature Camp (Narkanda) however had 80 and 90 per cent staff from the local community respectively, but were not employed at the managing posts thus making them the least sustainable of all in terms of local employment. More than 90 per cent of the staff members employed at Himalayan Nature Camp (Jalodi) and Aamod (Dalhousie) comprised of the local people with some educated people on managerial responsibilities. The total staff employed at the sites mostly included manager, housekeeping staff, maintenance staff, kitchen staff, accounting staff, catering staff, security personnel and sports trainer and multipurpose men.

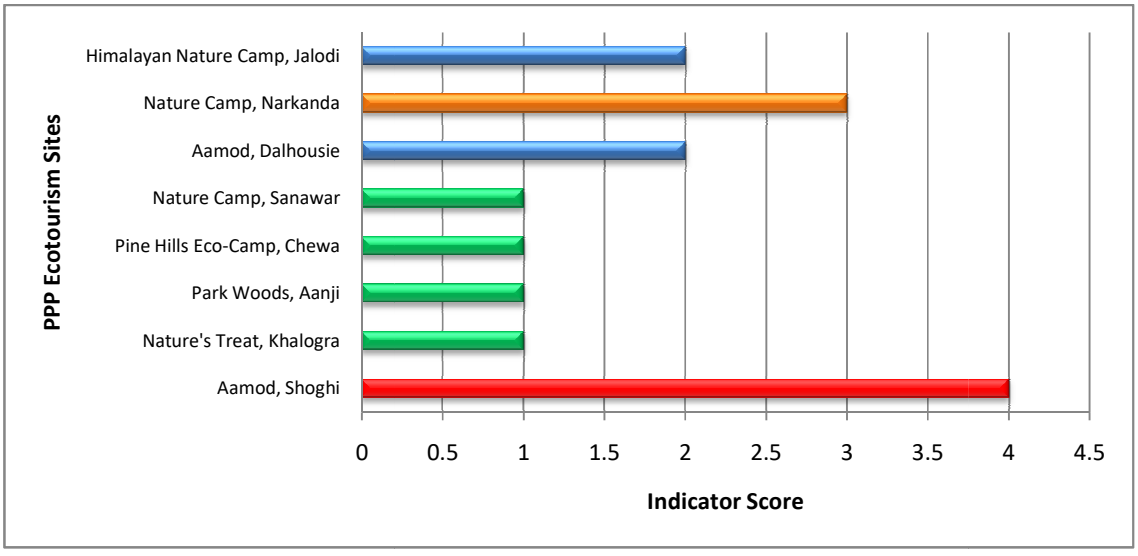


Fig. 4.22: Local employment indicator score for PPP ecotourism sites

On the contrary, as depicted in Fig. 4.23 Departmental sites followed the order Ecotourism site, Paneo (4) and Children's Park, Hamirpur (4) > Ecotourism site, Sahoo (3) = Ecotourism site, Holi (3) = Ecotourism site, Devidarh (3) > Nature Park, Jhiri (2) =

Ecotourism site, Kasol (2) > Ecotourism site, Prashar (2). Staff at these sites is mostly people employed by the State Forest Department. Ecotourism site (Paneo) and Children's Park Hamirpur not only have very less number of employees but also none of the staff belonged to the nearby area, thus making these sites the least sustainable in this category. The Ecotourism site at Sahoo, Holi and Devidarh however, had less number of staff, majority of which belonged to the nearby locality. Further, Nature Park (Jhiri) and Ecotourism site (Kasol) were ranked lower than the earlier mentioned sites as locals were given employment on temporarily basis for work like cooking, gardening and other multipurpose tasks. Ecotourism site (Prashar) on the other hand was ranked lowest because all the staff members at the site were the local villagers except one.

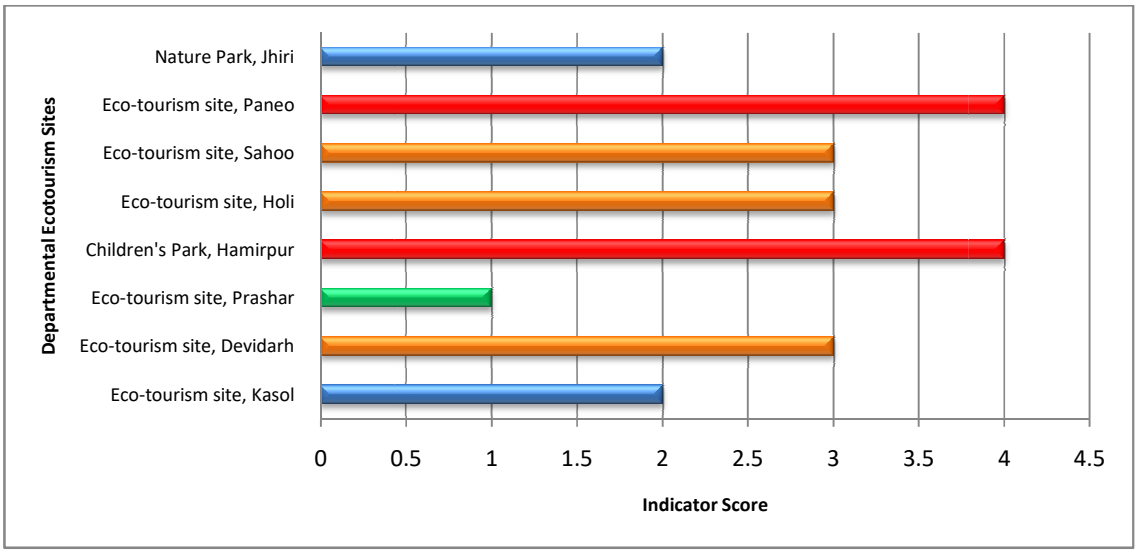


Fig. 4.23: Local employment indicator score for Departmental ecotourism sites

The total score calculated for the PPP sites is 15 and that for Departmental Sites is 22 which as graphically depicted in Fig. 4.24. Very less number of staff is employed at Departmental site than the PPP sites, making the later sites more sustainable than the former sites. The difference lies because at Departmental sites not many facilities are available nor the accommodation is much thus, requiring less number of staff. Also, the economic benefit is centrally managed by the Ecotourism wing for these sites, which is not being divided amongst the sites making it tough for the regional forest branches to enhance the ecotourism activities on site and employ more people. PPP sites on the other hand are managed as a business venture by the site owners who further employ locals according to need and facilities being provided at the ecotourism site.

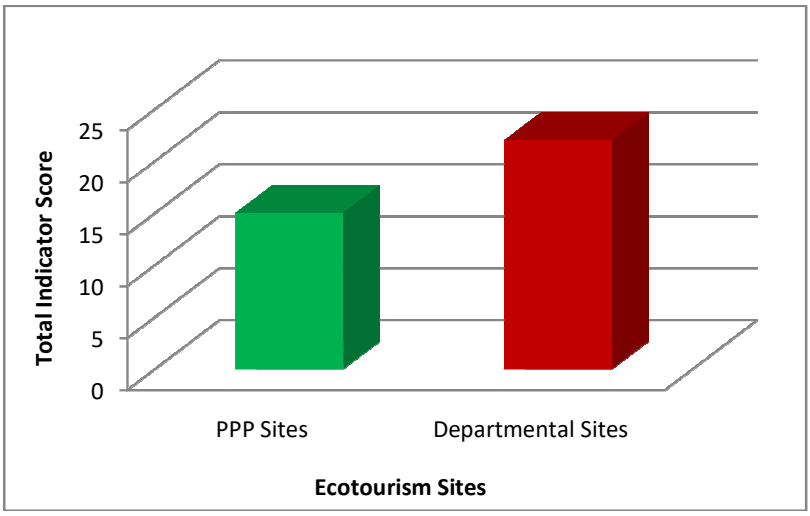


Fig. 4.24: Site wise total score for local employment indicator

Community Involvement

Nature and extent of involvement of local residents in various ecotourism activities, planning and decision making for the various sites was considered while ranking this indicator. PPP sites followed the order Aamod, Shoghi (5) > Nature Camp, Narkanda (3), Nature Camp, Sanawar (3) = Parks Wood, Aanji (3) = Nature's Treat, Khalogra (3) > Himalayan Nature Camp Jalodi (2) = Aamod Dalhousie (2) = Pine Hills Eco-Camp Chewa (2) as depicted in Fig. 4.25. No involvement of local community was observed at Aamod (Shoghi). Nature Camp (Narkanda), Nature Camp (Sanawar), Parks Wood (Aanji) and Nature's Treat (Khalogra) were also ranked higher due to less community involvement. At these sites community involvement was observed in the form of interaction for local resource use. No active involvement of local communities was seen for decision making purposes in the selected ecotourism sites, although community involvement is one of the crucial socio-cultural principle of ecotourism. Himalayan Nature Camp (Jalodi), Aamod (Dalhousie) and Pine Hills Eco-Camp (Chewa) however conducts meetings with the locals from time to time on their views about the program, local folk dancers are invited for evening shows and tourists are made to interact with locals to participate in customs and even harvesting sometimes. At Aamod (Dalhousie) site managers have come up with another innovative idea for community involvement by making the tourist adopt a sapling which they can monitor periodically. Therefore, the last three sites were ranked lower for community involvement indicator than the other sites.

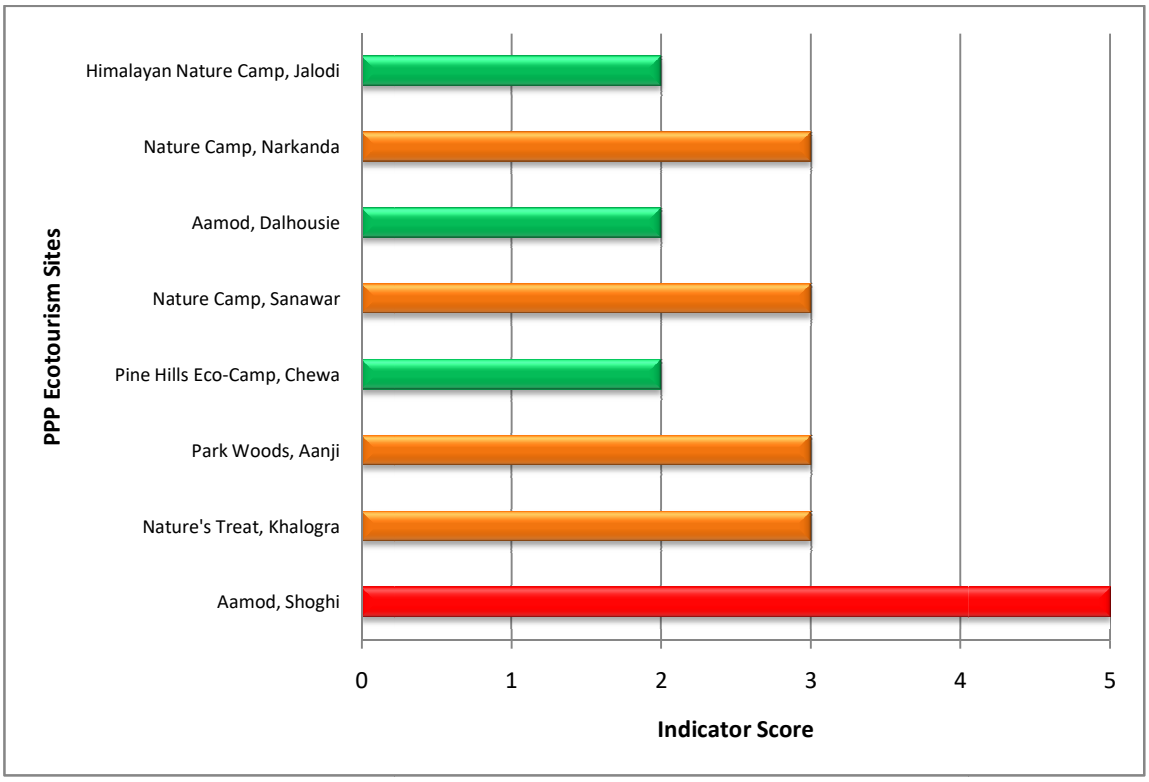


Fig. 4.25: Community involvement indicator score for PPP ecotourism sites

Departmental ecotourism sites were also ranked for this indicator as depicted in Fig. 4.26, and the sites were found to follow the given order Ecotourism site, Paneo (4) = Ecotourism site Sahoo, (4) = Children's Park, Hamirpur (4) > Nature Park, Jhiri (3) = Ecotourism Site, Holi (3) = Ecotourism Site, Devidarh (3) = Ecotourism Site, Kasol (3) > Ecotourism site, Prashar (2). It was concluded that except at Ecotourism site (Prashar) none of the other sites had much kinds of community involvement. At Ecotourism site (Prashar) some space is provided to the local youth group for functioning after complete set up by the Forest Department of that particular division, as a result the youth migration has reduced and they are operating the site efficiently. Next to Ecotourism site (Prashar), other sites including Nature Park (Jhiri), Ecotourism Site (Holi), Devidarh and Kasol on the other hand have very little community involvement. At these sites the help of local trekking guides is taken to facilitate tourists, and at Nature Park (Jhiri) locals rafting guides are involved in ecotourism activity. However, at Ecotourism site (Paneo), Sahoo and Children's Park (Hamirpur) community involvement of any kind is not there.

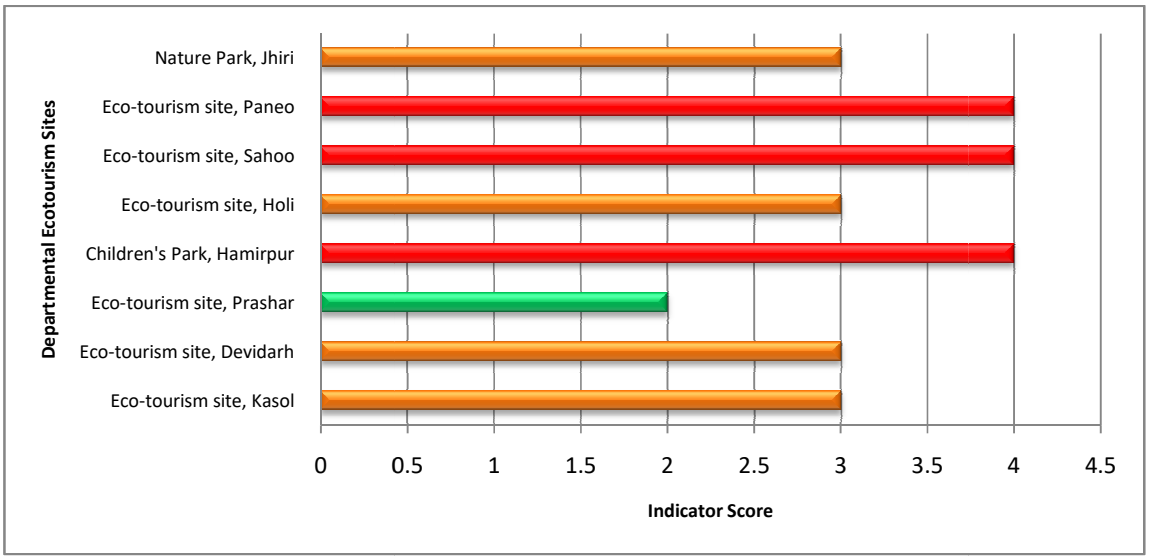


Fig. 4.26: Community involvement indicator score for Departmental ecotourism sites

Therefore for the community involvement indicator, the total indicator score taken by the PPP sites is 23 and that taken by the Departmental sites is 26 amongst the two the former sites were found to be more sustainable for this indicator than the later, which is evident from the data presented Fig. 4.27. The difference in sustainability for this particular indicator can be attributed to, less involvement of locals in the Departmental ecotourism activities, community members are not invited by the Forest Department during decision making process or any other activity, while at PPP sites the managers try to incorporate new and innovative ideas to involve locals in ecotourism activities thus not only enhancing tourist facilitation but also fosters locals as stakeholders for sustenance and growth of their venture.

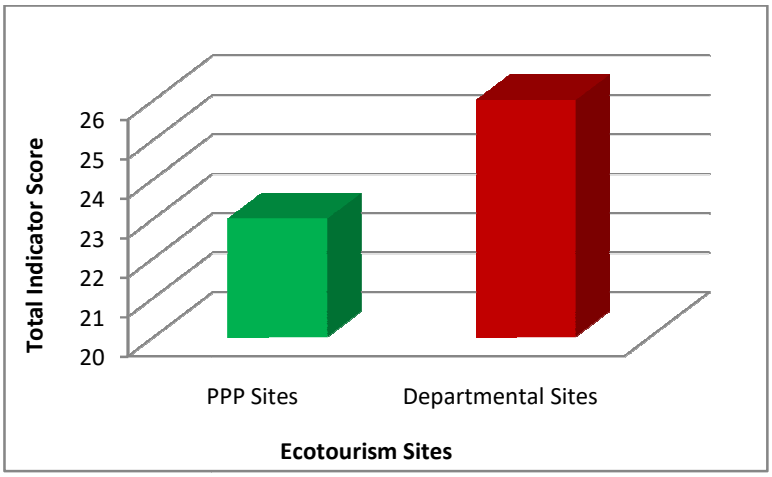


Fig. 4.27: Site wise total score for community involvement indicator

Sustainability Status of Ecotourism Activities

The mean rank taken by the selected indicators for PPP sites is depicted in table 4.1, the mean score calculated for individual sites for all the indicators was found in the order of Aamod, Shoghi (53.33) > Nature Camp, Narkanda (40.56) > Parks Wood, Aanji (38.06) > Aamod, Dalhousie (36.17) > Nature Camp, Sanawar (34.39) > Nature's Treat, Khalogra (33.89) > Himalayan Nature Camp, Jalodi (28.79) > Pine Hills Eco-camp, Chewa (26.83). Aamod (Shoghi) was found to be the least sustainable, while Pine Hills Eco-camp (Chewa) was found to be the most sustainable PPP ecotourism site. The results can be attributed to the fact that the Aamod site at Shoghi was ranked highest for most of the indicators because of the reasons i.e. the site has very high electricity consumption and the managers of the site have not installed any solar panels; a lot of concrete structures are present on site; in addition to the high amount of water being utilized and maximum number of water tankers being bought. Other reasons include, very high cost of stay and no involvement of the locals in any of the activity, also the site has not employed locals at some higher managerial post. On the other hand, site at Chewa did not score above 3 for any of the selected indicators and thus was found to be most sustainable because of the reasons that site meets some of its electricity demand from solar energy; the waste generated is properly segregated and the organic portion is composted; the site has sufficient area and various facilities for tourists facilitation in addition to nominal cost of stay. The site has improved community involvement in different ways for instance the tourists are involved in crop harvesting activities seasonally and also the staff employed at the site is mostly from nearby areas.

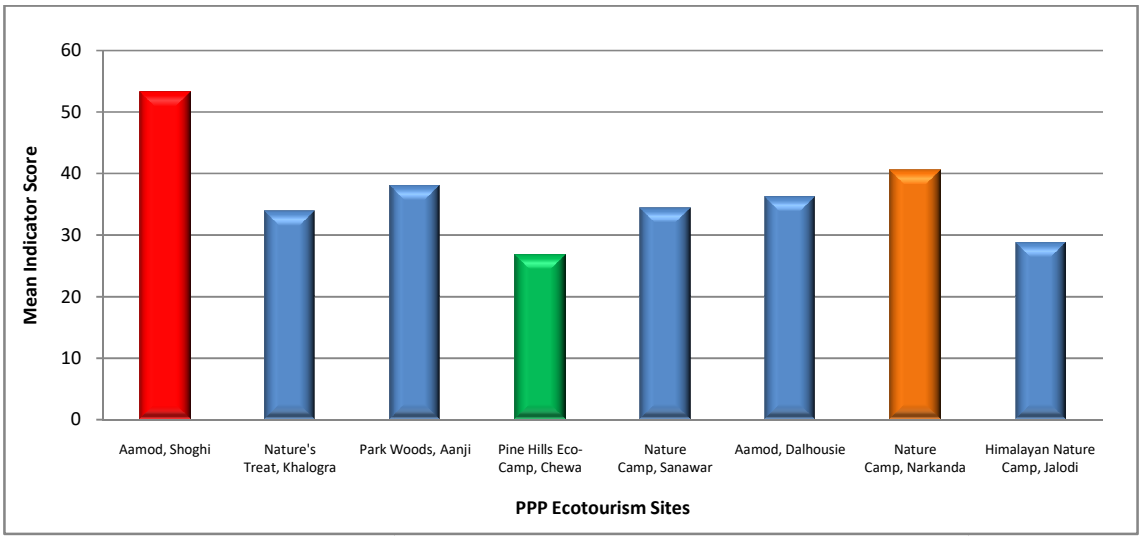


Fig. 4.28: Sustainability status of PPP ecotourism sites

PPP activities were found to impact the indicators in the following order potable water demand (28) > energy consumption (24) = waste management (24) = cost to users (24) > community involvement (23) > tourists facilitation (20) > biocapacity (18) > building material (16) > local employment (15) as depicted in Fig. 29. The data presented in table 4.1revealed that the potable water demand indicator was highly impacted by the PPP ecotourism activity, this is due to the reason that site mangers have not taken initiatives to harvest rain water or water from any other nearby source. Following is the energy consumption, waste management and cost to users indicator, these were also highly impacted because of the high electricity consumption as the tourists inflow on the sites is more; more waste generated and high dependency of the sites on MCDs for its disposal and very high cost of stay at most of the sites. The sites functioning on this mode have employed a good number of locals thus the impact on this indicator was observed to be minimum.

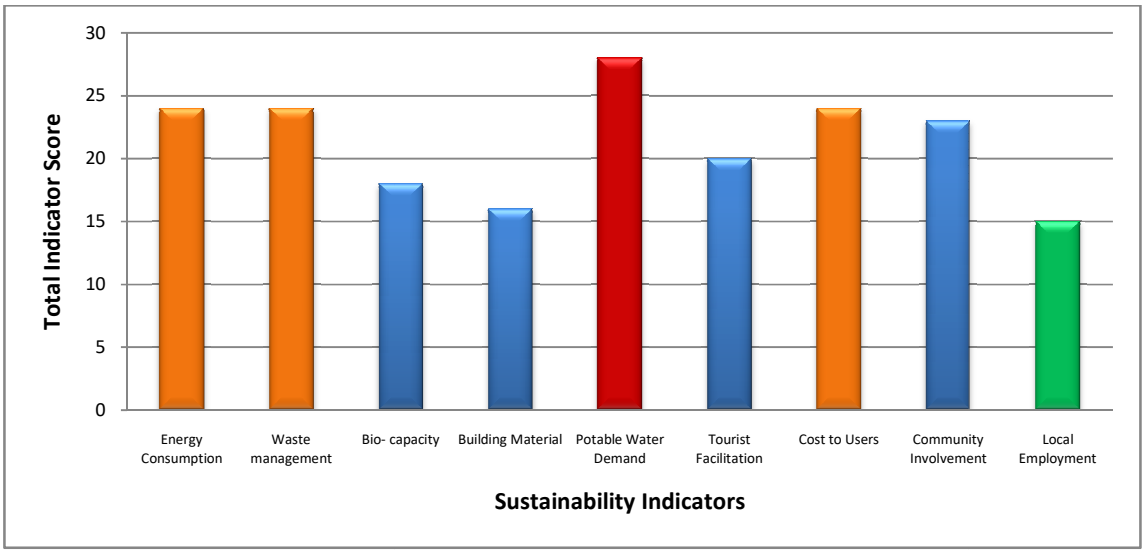


Fig.4.29: Status of sustainability indicators for PPP activities

The Departmental sites as per the total sustainability score followed the order Ecotourism Site, Paneo (50.28) > Ecotourism site, Sahoo (42.11) > Nature Park, Jhiri (38.17) > Ecotourism site, Holi (36.83) > Children's Park, Hamirpur (34.44) > Ecotourism site, Devidarh (33.11) > Ecotourism site, Kasol (30.39) > Ecotourism Site, Prashar (26.67) as depicted in Fig. 4.30. The results can be attributed to the fact that at the Paneo site not only the energy consumption was high but also improper waste disposal practices were being followed. No facilities were available for tourists entertainment except the nature walk trail also the community involvement was nil.

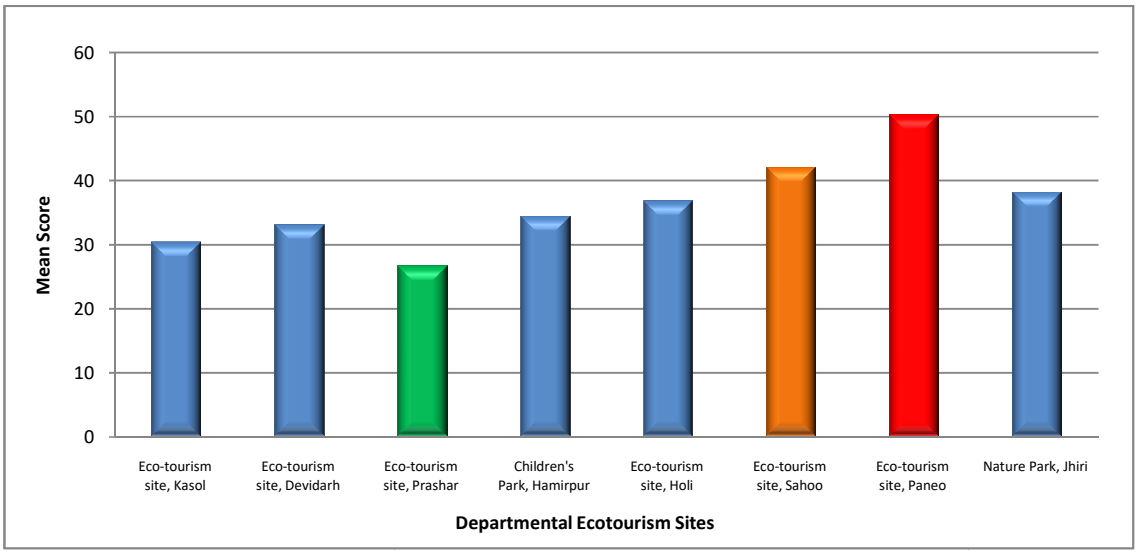


Fig. 4.30: Sustainability status of Departmental ecotourism sites

The impact of Departmental activities on the selected indicators was also assessed and was found in the order of energy consumption (30) = waste management (30) > community involvement (26) > building material (25) = tourist facilitation (25) > local employment (22) > potable water demand (20) > cost to users (18) > bio-capacity (17) as depicted by the total rank score for each indicator depicted in Fig. 4.31. The results were obtained due to the following reasons, all the sites were completely dependent on conventional electricity supply; scientific waste management is not followed; the local community members are not involved in any of the ecotourism activity at most of the sites. But the departmental sites are economical in terms of cost to users and have ample area for improving ecotourism activities.

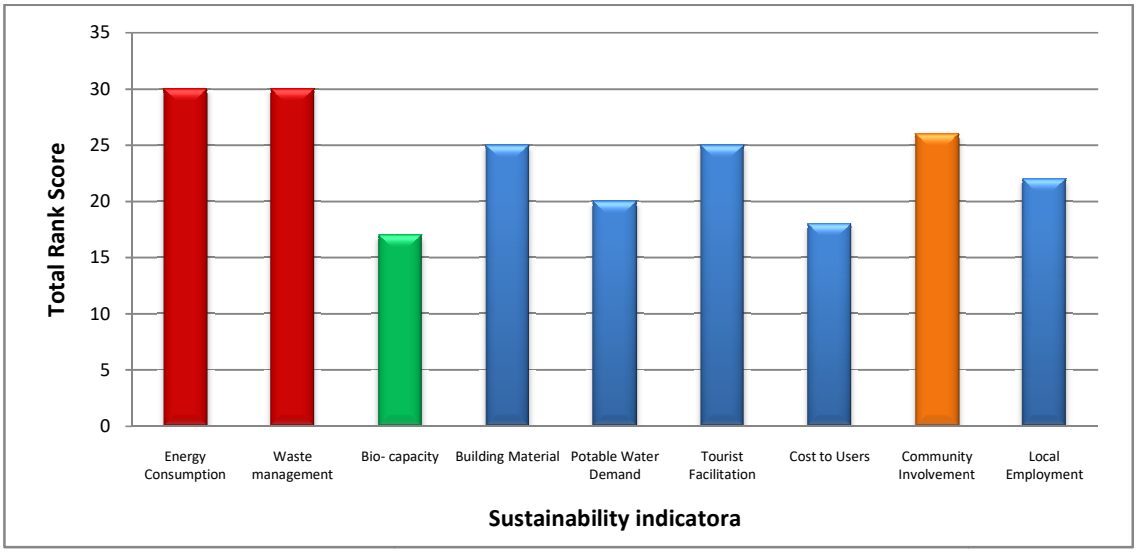


Fig. 4.31: Status of sustainability indicators for Departmental activities

Comparing the sustainability status of both the modes of ecotourism activity, PPP ecotourism activity attained a mean rank score of 8.11 while Department activity scores 10.89, the scores indicated that former activities were more sustainable than the later one (Fig. 4.32). PPP sites have an edge in terms of energy consumption, waste management, building material, tourist facilitation, community involvement and local employment. However, Departmental sites scored less for indicators including potable water demand, cost to users and bio-capacity to certain extend. While analyzing the impact of ecotourism activity on the indicators it was also found that the most impacted indicator is the potable water demand for the PPP sites while it is energy consumption and waste management for the Departmental sites. On the other hand the local employment indicator was found to be least impacted by the PPP ecotourism activities while bio-capacity was found to be the least impacted by the Departmental ecotourism activities.

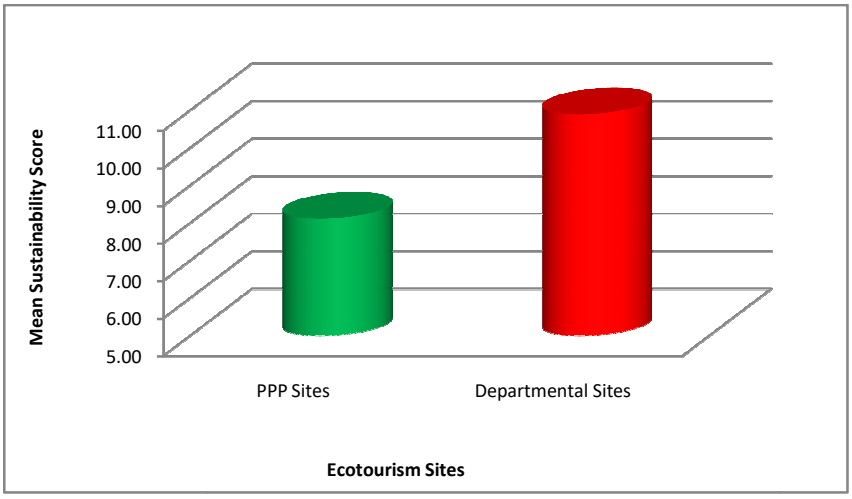


Fig. 4.32: Site wise sustainability status of ecotourism activities

Similar model for sustainability assessment was followed by Thomas *et al*. (2013) for assessment of sustainability in the Caribbean region and it was concluded that the sensitivity analysis assessment tool responded well to social and demographic changes, and evaluation of average impact differentials across each core pillar of sustainability (environmental, societal and economic) could be used to plan for possible future detrimental impacts and hence the sustainability of ecotourism activity.

Higher sustainability at certain sites than the other can be attributed to the use of greener alternatives for various facilities running and operating on sites like the use of solar energy for meeting some extend of electricity demand. The results are in line with the

findings of Sharma, 2018 who have also indicated that the role of green initiatives adoption for making ecotourism more sustainable. In order to serve one of the most important purpose of ecotourism that is not to interfere with the electricity utilization of the nearby villages and habitations, the ecotourism setup should necesarily focus on other sources of energy like solar or biogas to atleast some extend which will help the sites to be more sustainable.

Use of nature friendly building material for developing the site (tents, bamboo cottages, reused plastic) and scientific waste management methods (waste segregation and composting) followed also guarantees the sustainable functioning of this setup in any region. Lone *et al.*, 2013 in their study of ecotourism in Bangus valley of J&K also ascertained that infrastructure is the most limiting factor of the tourism activities which can be overcome with proper ecotourism development starts in the region. Farrell & Runyan 2001 and Bhattacharya, et al. 2011 also ascertained that ecotourism includes sustainable use of environmental resources for operations. Fadahunsi, 2011 has also pointed out some risks that can be avoided while setting a ecotourism site like construction of accommodation and other services that has a direct impact on environment from vegetation removal to impact on drainage, by using nature friendly material in addition to the risk that improper waste disposal can pose for the sustenance of the ecotourism activity in any area. Weaver and Lawton (2007) also pointed that ecotourism has an important standard that no waste should overflow from the site to avoid any type of contamination of nearby environment (water, soil and air).

Other factors contributing to better environmental sustainability of certain sites include better utilization of surrounding natural resources and topography for ecotourism purposes like water harvesting, trails for walking/cycling, trekking and setting adventure sports activities with the help of surrounding trees. Knowing its conservation importance, ecotourism has been adopted in many protected areas of India as reported by Ramavarapu, 2017. Kipper (2013) also ascertained that the main aim of ecotourism is to conserve resources, especially biological diversity, and maintain sustainable use of resources, which can bring ecological experience to travelers, conserve the ecological environment and gain economic benefit. In addition certain sites in view of understanding the importance of surrounding environment and resources have further initiated works like plantations, cleaning campaigns.etc that further adds to the sustainability of ecotourism activities in the area. Weaver and Lawton (2007) have also added that it is crucial for ecotourism to maintain the

ecosystem, its physic-chemical condition and quality where the ecotourism attraction is located.

Tourist satisfaction being one of the most important factors for the sustenance of the sites is considered seriously and handled efficiently at certain sites making them more sustainable than the others. Mattews (2002) has also focused on the aspect that ecotourism should provide a quality tourism experience as reported by. Vujko and Plavsa (2014) in their study of National Park in Serbia also reported that one of the main attractions of tourist inflow in the park is directly related to the improved sports and recreational tourism made available to the tourists. The results are also in accordance with the ones concluded by Bahmanpour *et al.* (2012) who indicated that the users are interested in mountain climbing the most and similar activities taking place in natural environments. In addition, attraction underlying mountain climbing, caving, jogging, strolling, hiking, and mountain biking are important for tourists engagement.

Extended community involvement in the form of regular meetings for decision making on ecotourism activities being operated in the area and participation in some other activities makes the ecotourism activity more sustainable from socio-cultural viewpoint. The results of the present study are in line with the ones found by Sambotin *et al.*, (2011) who has reported that for ecotourism to be sustainable community involvement in planning, development and operational activities and its contribution in welfare is necessary. In ecotourism destinations in Kerala and Sikkim, also the state forest department has been successful in adopting a much innovative approach of developing ecotourism by involving local communities as reported by Kumari *et al.* 2005; Ashok *et al.* 2017 and Ramavarapu 2017. A study conducted by Nyaupane and Thapa (2010) also concluded that residents of the ecotourism area perceived fewer negative and positive impacts (environmental, economic, socio-cultural) as a result of ecotourism than the residents of the traditional tourism area. Rubita (2012) and Bhaduria (2016) have reported that the reason for ecotourism success in Sikkim is the active involvement of Community based organizations, village people, allocation of funds for organizing regular workshops for environmental awareness and training programs for capacity building. According to Patterson (2002) also ecotourism should necessarily hire locals and buys supplies locally where possible.

Table 4.1: Ranking of PPP ecotourism sites for sustainability indicators

PPP Ecotourism Sites	Sustainability Indicators									Mean Rank
	Energy Consumption	Waste management	Bio-capacity	Building Material	Potable Water Demand	Tourist Facilitation	Cost to Users	Community Involvement	Local Employment	
Aamod, Shoghi	5	3	2	5	5	1	4	5	4	52.89
Nature's Treat, Khalogra	2	5	3	2	2	3	2	3	1	33.28
Park Woods, Aanji	3	2	2	3	4	3	3	3	1	37.22
Pine Hills Eco-Camp, Chewa	3	2	2	1	3	2	3	2	1	26.17
Nature Camp, Sanawar	2	4	3	1	3	3	3	3	1	35.39
Aamod, Dalhousie	4	2	2	2	4	2	4	2	2	35.50
Nature Camp, Narkanda	4	2	3	1	3	3	3	3	3	41.56
Himalayan Nature Camp, Jalodi	1	4	1	1	4	3	2	2	2	30.00
Total rank score	24	24	18	16	28	20	24	23	15	

Table 4.2: Ranking of Departmental ecotourism sites for sustainability indicators

Departmental Ecotourism Sites	Sustainability Indicators									Mean Rank
	Energy Consumption	Waste management	Bio-capacity	Building Material	Potable Water Demand	Tourist Facilitation	Cost to Users	Community Involvement	Local Employment	
Eco-tourism site, Kasol	4	3	2	3	1	3	3	3	2	30.39
Eco-tourism site, Devidarh	3	4	2	3	1	4	2	3	3	33.11
Eco-tourism site, Prashar	4	3	1	3	2	3	3	2	1	26.67
Children's Park, Hamirpur	2	5	2	2	3	3	1	4	4	34.44
Eco-tourism site, Holi	4	4	2	3	3	3	2	3	3	36.83
Eco-tourism site, Sahoo	4	3	3	4	3	3	2	4	3	42.11
Eco-tourism site, Paneo	4	4	3	3	4	4	2	4	4	50.28
Nature Park, Jhiri	5	4	2	4	3	2	3	3	2	38.17
Total rank score	30	30	17	25	20	25	18	26	22	

More number of locals employed in ecotourism activities is another reason for contributing towards the sustenance of this industry in any region at certain sites. Kipper (2013), also suggested that ecotourism potentially can provide for alternative livelihoods for the local people and provide direct benefits that might offset pressure from other less sustainable activities. It helps to provide jobs for local people as well as drive development of related industries like services, raw material supply, etc. as reported by Rangaswamy (2012). Funnel and Bynoe, 2007 also added that ecotourism materially assist in improving the livelihoods of local people thus satisfying both conservation and livelihood demands. Watkin, 2003 and Kiper *et al.* 2011 while reporting the effects of ecotourism in countries worldwide acknowledged that ecotourism is responsible not only for revenue generation but also employment diversification, capacity building and opportunities for women.

4.1.2 CARRYING CAPACITY OF ECOTOURISM SITES

PCC, RCC and ECC were determined using the collected data and the results obtained for all the 16 sites are presented, inter and intra comparison amongst the sites is also discussed as follows:

Physical Carrying Capacity of Ecotourism Sites in Himachal Pradesh

The results for PPP sites as depicted in table 4.3, indicates that PCC was found highest for Nature Camp, Narkanda (4500 visitors^{-day}) followed by Himalayan Nature Camp, Jalodi (2400 visitors^{-day}) > Nature's Treat, Khalogra (2334 visitors^{-day}) > Aamod, Dalhousie (1980 visitors^{-day}) > Pine Hills Eco-Camp, Chewa (1945 visitors^{-day}) > Nature camp, Sanawar (1619 visitors^{-day}) > Aamod, Shoghi (806 visitors^{-day}). PCC is directly proportional to the area available for ecotourism activity thus the site with more PCC means availability of large area for the purpose.

The data after carrying capacity assessment for Departmental sites as presented in table 4.4, indicated that the PCC as high as 12000 visitors^{-day} was determined for Ecotourism Site (Prashar) and Children's Park (Hamirpur) which indicates the availability of sufficient area for developing the sites. These are followed by Ecotourism site, Holi (6000 visitors^{-day}) > Ecotourism site, Devidarh (4000 visitors^{-day}) > Ecotourism site, Paneo (4264 visitors^{-day}) >

Ecotourism site, Kasol (1714 visitors^{-day}) > Ecotourism site, Sahoo (1509 visitors^{-day}) > Nature Park, Jhiri (1419 visitors^{-day}). PCC value for most of the sites is very high as the State Forest Department has demarcated and allocated sufficient area for setting ecotourism activities.

Table 4.3: Status of Physical, Real, Effective Carrying Capacity and the actual number of visits for PPP sites

PPP Ecotourism Sites	PCC (visitors^{-day})	RCC (visitors^{-day})	ECC (visitors^{-day})	Actual number of visits (visitors^{-day})
Aamod, Shoghi	**806**	**277**	179	**120**
Nature's Treat, Khalogra	2334	802	220	70
Park Woods, Aanji	863	296	**143**	80
Pine Hills Eco Camp, Chewa	1945	669	209	**40**
Nature Camp, Sanawar	1619	556	211	50
Aamod, Dalhousie	1980	430	373	82
Nature Camp, Narkanda	**4500**	**1587**	**1079**	42
Himalayan Nature Camp, Jalodi	2400	847	525	52

Table 4.4: Status of Physical, Real, Effective Carrying Capacity and the actual number of visits for Departmental sites

Departmental Ecotourism Sites	PCC (visitors^{-day})	RCC (visitors^{-day})	ECC (visitors^{-day})	Actual number of visits (visitors^{-day})
Ecotourism site, Kasol	1714	589	**120**	15
Ecotourism Site, Devidarh	4000	1225	975	150
Ecotourism Site, Prashar	12000	3859	**3635**	150
Children's park, Hamirpur	12000	4051	2025	100
Ecotourism Site, Holi	6000	1304	972	60
Ecotourism Site, Sahoo	1509	328	213	50
Ecotourism Site, Paneo	4264	1505	888	70
Nature Park, Jhiri	1419	433	369	120

Amongst both the types of sites, Departmental sites on an average were found to have have more PCC than the PPP sites because of the availability of more area for developing the ecotourism activities. On the other hand, private firms are allocated limited area for setting the

venture, making Departmental sites more sustainable in terms of PCC than the PPP sites. Availability of large areas provides long term opportunities to manage and operate ecotourism activities, by providing sufficient space and resources for the purpose. But PCC in no way indicates the number of tourists that can be accommodated at a site, so for extracting the actual number of tourists i.e. the ECC, PCC is further refined to RCC and ECC by incorporating various limiting/managerial factors and aspects including environmental, social, personnel, infrastructure, etc. that restricts the number of visitors that a site can sustain. Lagmoj *et al.*, (2013) have also calculated the PCC and obtained the carrying capacity as 3712 persons/day in Khorma forest Iran. Zacarias *et al.*, (2011) in their study in Portugal have concluded that the physical carrying capacity is reported as 1491-2982 visitors^{-day}, the author has further pointed out that these values should not be seen as the number that can be accommodated permanently but alternatively the socio-cultural and physic-ecological carrying capacity has to be determined. The correction factors like precipitation, very hot days and very cold days were added as these are intrinsically related, and influence the flow of people. Similar results were found for the Termessos National Park, Turkey, where the visitation to the park and the use level of the trails therein depended upon the season and weather conditions (Sayan and Atik, 2011).

Real Carrying Capacity and Effective Carrying Capacity Comparison for Ecotourism Sites

Comparing RCC and ECC reveals the gap that can be minimized by proper management of any ecotourism site in terms of availability of accommodation facilities, recreational facilities and trained staff on site for tourist facilitation and engagement. ECC can be brought near to the RCC with proper management of the site in various aspects to accommodate more tourists and extract maximum socio-economic benefit from the activity.

In case of PPP sites the difference in RCC and ECC was found maximum for Nature's Treat, Khalogra (582 visitors^{-day}) followed by Nature Camp, Narkanda (508 visitors^{-day}) > Pine Hills Eco-Camp, Chewa (460 visitors^{-day}) > Nature Camp, Sanawar (345 visitors^{-day}) > Himalayan Nature Camp, Jalodi (322 visitors^{-day}) > Aamod, Shoghi (153 visitors^{-day}) as depicted in Fig 4.33. Whereas, Aamod (Dalhousie) has the minimum difference between RCC and ECC i.e. 57 visitors^{-day}, indicating that this site has the least scope to enhance tourist intake even after further improving/enhancing different managerial aspects.

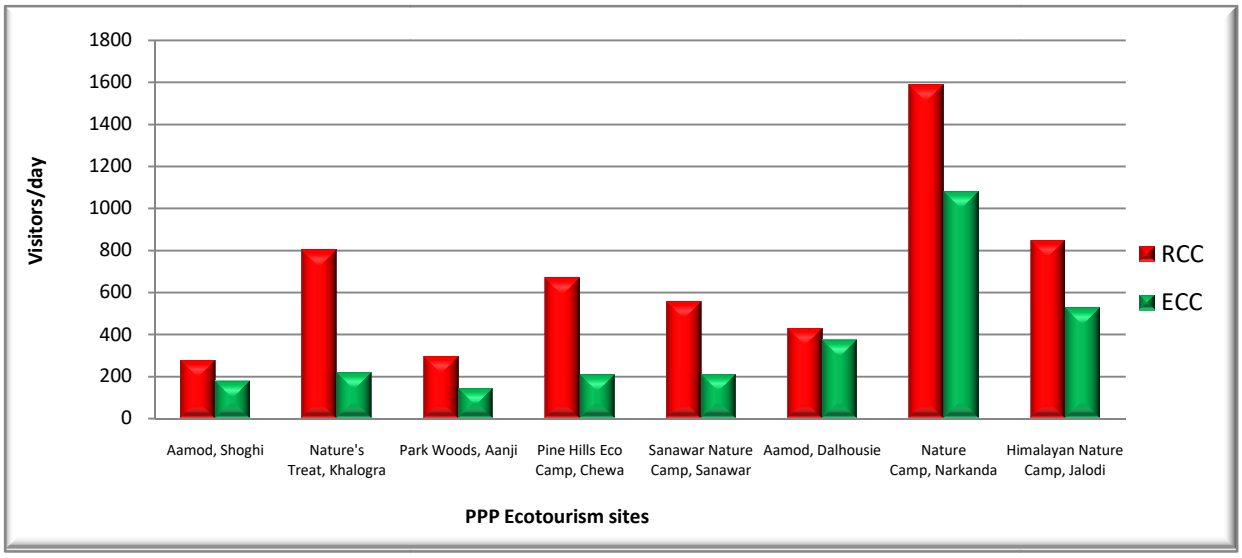


Fig. 4.33: Status of RCC and ECC for PPP ecotourism sites

For Departmental sites on the other hand, the site with difference in RCC and ECC were found in the order of Children's Park, Hamirpur (2026 visitors^{-day}) > Ecotourism site, Paneo (617 visitors^{-day}), Ecotourism site, Kasol (460 visitors^{-day}) > Ecotourism site, Holi (332 visitors^{-day}) > Ecotourism site, Devidarh (250 visitors^{-day}) > Ecotourism site, Prashar (224 visitors^{-day}) > Ecotourism site, Sahoo (115 visitors^{-day}) as depicted in Fig. 4.34. Site with the least difference was Nature Park, Jhiri (64 visitors^{-day}), the results indicated that sites with wider gap have wide scope for improvement in the management of the site for inviting more visitors while site with less difference have not much scope left for increasing the number of visitors that can be accommodated at the site. The results are in line with the findings of Lagmoj *et al.*, (2013) who have calculated the Real Carrying Capacity of Khorma forest in Iran considering limiting factors including the number of very hot days and the number of wet days, was found to be 2001 persons^{-day} and effective carrying capacity, taking the management capabilities including the number of manpower and the budget to be 69 persons $^{-day}$.

The difference in RCC and ECC can be attributed to the unharnessed area that can be brought under ecotourism activity and lack of management facilities for visitors. On an average Departmental sites have more scope for improvement and can accommodate more tourists on account of a much wider gap between RCC and ECC at the ecotourism sites. Thus indicating higher sustainability of Departmental sites than the PPP sites. Queiroz *et al.*, (2014) in a case

study from the north Atlantic Islands in Portugal, have reported that the two trekking trails had RCC of 118 visitors^{-day} and 557 visitors^{-day} and none of the studied trails have reached the capacity.

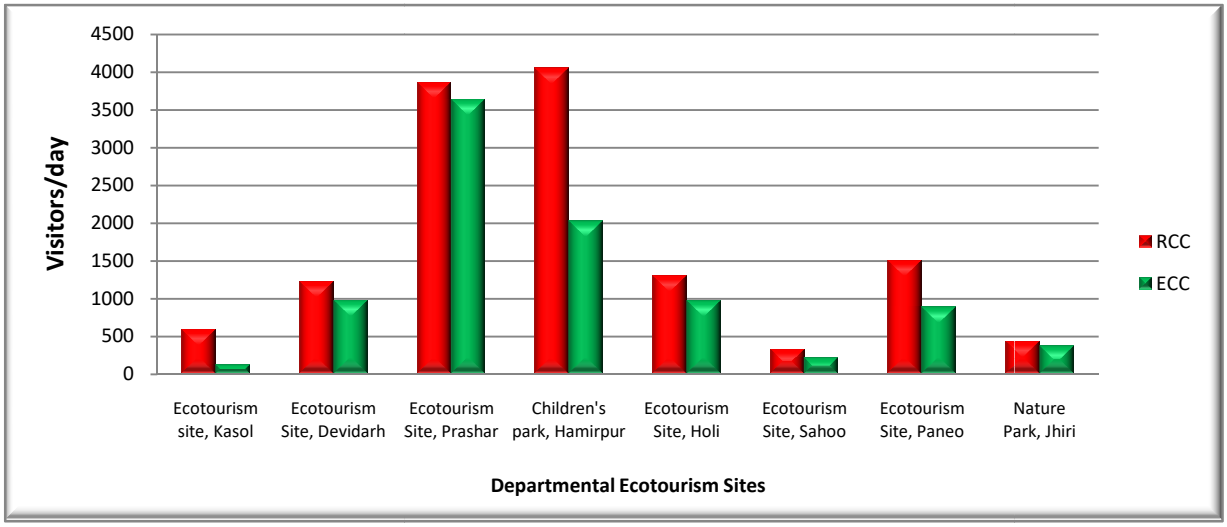


Fig. 4.34: Status of RCC and ECC for Departmental ecotourism sites

Effective Carrying Capacity and Actual Number of Visits Comparison for Ecotourism Sites

The difference in the number of ECC and the actual number of visits per day at any site indicates the number of tourists that can further be accommodated at the site if arrivals put in an appearance, on account of facilities and staff available. This gap also indicates that whether the flow of tourists towards ecotourism activities is less or more. For PPP sites, as depicted in Fig. 4.35, the calculated difference between ECC and actual number of visits was found in the order of Nature Camp, Narkanda (1037 visitors^{-day}) > Himalayan Nature Camp, Jalodi (473 visitors^{-day}) > Aamod, Dalhousie (291 visitors^{-day}) > Pine Hill Eco-Camp, Chewa (169 visitors^{-day}) > Nature Camp, Sanawar (161 visitors^{-day}) > Nature's Treat, Khalogra (150 visitors^{-day}) > Park Woods, Aanji (63 visitors^{-day}) > Aamod, Shoghi (59 visitors^{-day}). ECC for most of the sites was beyond the actual number of tourists that visit the site. The results indicated that the PPP ecotourism activities are well within the carrying capacity limits and that the sites can manage more tourists on arrival. Bhardwaj *et al.*, (2019) in their impact assessment study of an ecotourism site in Himachal Pradesh have also illustrated that the carrying capacity of an ecotourism site is still in its infancy stage due to low impact tourism activities.

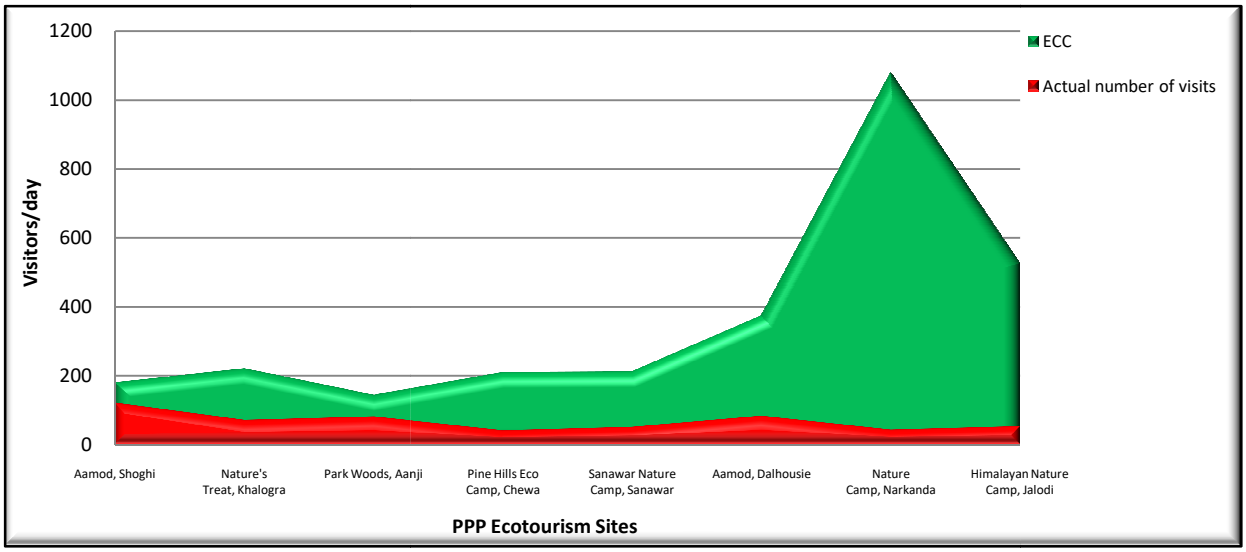


Fig. 4.35: Status of ECC and actual number of visits for PPP ecotourism sites

As depicted in Fig. 4.36 the calculated difference between ECC and actual number of visits for Departmental sites was in the order of Ecotourism Site, Prashar (3438 visitors^{-day}) > Children's Park, Hamirpur (1925 visitors^{-day}) > Ecotourism site, Holi (912 visitors^{-day}) > Ecotourism site, Devidarh (825 visitors^{-day}) > Ecotourism site, Paneo (818 visitors^{-day}) > Nature Park, Jhiri (249 visitors^{-day}) > Ecotourism site, Sahoo (163 visitors^{-day}) > Ecotourism site, Kasol (105 visitors^{-day}) . For all the sites ECC was beyond the actual number of tourists that visit. The results also indicated that the sites have good scope to accommodate more tourists on visit but with adequate management practices.

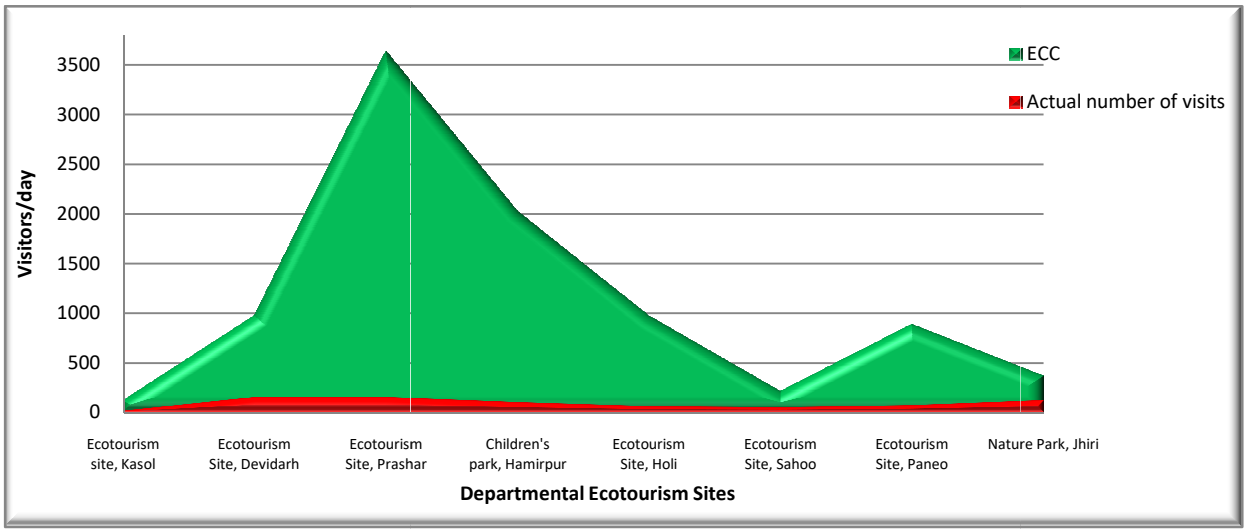


Fig. 4.36: Status of ECC and actual number of visits for Departmental ecotourism sites

The actual number of tourists visiting the sites per day was well within the carrying capacity limits at all the sites may it be PPP or Departmental. This gap between ECC and actual number of visitors per day indicates that the flow of tourists towards ecotourism activities is quite less. Tourist inflow to Himachal Pradesh is as high as 1.72 Cr.**,** recorded in the year 2019, but due to lack of knowledge, marketing and awareness amongst the tourists, the concept of ecotourism has not yet attained the potential it has to divert the mainstream tourism to a more sustainable form of tourism called ecotourism. But before sensitizing the visitors towards this new venture being set up in the state, there is a need to properly plan, develop, enhance and manage the ecotourism industry to meet the demands of the incoming tourists. This gap between ECC and actual number of tourists can further be reduced by adopting planned strategies for promoting this nature friendly form of tourism. Some of the strategies for the purpose are also purposed in this study in the later section which is obtained using SWOT analysis of ecotourism activities in the state. The results are comparable to the ones determined by Bhardwaj *et al.*, (2019) who have estimated the effective carrying capacity of a private ecotourism site in Himachal Pradesh through the management capabilities that were achieved at 43 visitors^{-day} compared to tourist arrival of 28 visitors^{-day} far below its capacity. Armono *et al.*, (2017) in their study of ecotourism in Baluran National Park also concluded that the current number of tourist arrivals in only 241 people^{-day} which is far below the carrying capacity and a maximum of 3288 visitors^{-day} that can be accepted at one time, the study also showed that there is a high possibility to increase the number of tourists in the region. Similar results were obtained by Sharma *et al.*, (2020) in their study of carrying capacity assessment of ecotourism sites in mid hill region of Himachal Pradesh, in which the authors have found that the ECC ranged between 116 – 204 visitors^{-day}, although, the number of tourists visiting the sites per day in actual was within the carrying capacity limits.

Ecotourism Sustainability Projection

If the rate of tourist inflow remains the same for the ecotourism sites, the following projection as depicted in table 4.5 and 4.6, can be made about the number of years within which the sites can lose their present effective carrying capacity limits and thus sustainability.

As seen in table 4.5, among the PPP sites Nature Camp (Narkanda) has the longest period (40 years) i.e. it may lose its carrying capacity by 2061. Whereas, Aamod (Shoghi) has the shortest period (5 years) for exhaustion of its carrying capacity i.e. by the year 2026, followed by Park Woods, Aanji (7 years) < Nature's Treat, Khalogra (14 years) < Nature camp, Sanawar (18 years), Aamod, Dalhousie (19 years) < Pine Hills Eco-Camp, Chewa (21 years) < Himalayan Nature Camp, Jalodi (29 years) which may exhaust their carrying capacity by the year 2028, 2035, 2039, 2040, 2042 and 2050 respectively. whereas,) may reach its carrying capacity limit by. On an average, the PPP ecotourism sites in Himachal Pradesh will surpass their carrying capacity limits in the next 19 years if, management strategies being currently followed are not changed.

Table 4.5: Temporal projection for carrying capacity of PPP ecotourism sites

PPP Ecotourism Sites	Exhaustion (years)	Year
Aamod, Shoghi	5	2026
Nature's Treat, Khalogra	14	2035
Park Woods, Aanji	7	2028
Pine Hills Eco Camp, Chewa	21	2042
Nature Camp, Sanawar	18	2039
Aamod, Dalhousie	19	2040
Nature Camp, Narkanda	40	2061
Himalayan Nature Camp, Jalodi	29	2050

In case of Departmental ecotourism activities, however the site that may reach exhaustion at the earliest is Nature Park, Jhiri (14 years) followed by Ecotourism site, Devidarh (23 years) < Ecotourism site Kasol (26 years) < Ecotourism site, Sahoo (35 years) < Children's Park, Hamirpur (37 years), Ecotourism Site, Prashar (40 years) and Ecotourism site, Paneo (48 years) with exhaustion year 2035, 2044, 2047, 2056, 2058, 2061 and 2069 respectively. The site that has maximum time of 55 years to reach its capacity is Ecotourism site, Holi (2076). The average number of years for exhaustion of carrying capacity for Departmental sites, is 34 years.

Table 4.6: Temporal projection for carrying capacity of Departmental ecotourism sites

Departmental Ecotourism Sites	Exhaustion (years)	Year
Ecotourism site, Kasol	26	2047
Ecotourism Site, Devidarh	23	2044
Ecotourism Site, Prashar	40	2061
Children's park, Hamirpur	37	2058
Ecotourism Site, Holi	55	2076
Ecotourism Site, Sahoo	35	2056
Ecotourism Site, Paneo	48	2069
Nature Park, Jhiri	14	2035

The number of years for reaching the carrying capacity limit is much higher for the Departmental sites than the PPP sites. The difference in the year of exhaustion for different sites lies due to limitations of water and other natural resource availability, management strategy followed; increasing visitor frequency, enhanced conventional energy consumption, use of infrastructure which is incompatible with the ecosystem and untrained and less educated staff at sites for carrying ecotourism activities. Sharma *et al.*, (2020) also projected that, as per the current rate of tourist inflow in mid hill region of Himachal Pradesh, the carrying capacity of the ecotourism sites is predicted to get exhausted in the next decade on an average which can be attributed to limits in the environmental, social variables and the management capacities of the sites, this period can however be extended by adopting an environmentally friendly management strategy. Bhardwaj *et al.*, (2019) have also added in a study of an ecotourism site of Himachal Pradesh that the lack of on-site water availability although indicated a problem about abstraction from groundwater which could be worsened by an increase in tourists visiting the area. The indicators like preservation of landscape characteristics, energy, water and waste management specified on-going problems under each component which hindered the development of tourism activities. Hence, there is a current need for the management and tourism development as a road map for implementing sustainable tourism in the area. Masum *et al.*, (2013) in an ecotourism carrying capacity study of a safari park have also acknowledged that the ecological perspective of the ecotourism area will remain unaltered if the carrying capacities of the sites are followed with sustainability. Zacarias *et al.*, (2011) have also suggested that the difference between

physico-ecological and socio-cultural carrying capacity must be considered and the physico-ecological carrying capacity must be strictly followed for ecosystem management and ecotourism sustenance.

Effective Carrying Capacity (ECC) Comparison between PPP and Departmental Ecotourism Sites

The effective carrying capacity of both types of sites was compared and it was concluded that Departmental sites have higher average ECC (1150 visitors^{-day}) than the PPP sites (368 visitors^{-day}) as shown in Fig. 4.37. The number of person management, departmental sites has the ability to provide service for the tourists, was underutilized compared to the real carrying capacity at the PPP sites. Also, according to the visual observation performed in the area and study on available facilities, it was perceived that there were enough service facilities and infrastructures as well as suitable manpower for management and providing tourism services at PPP sites.

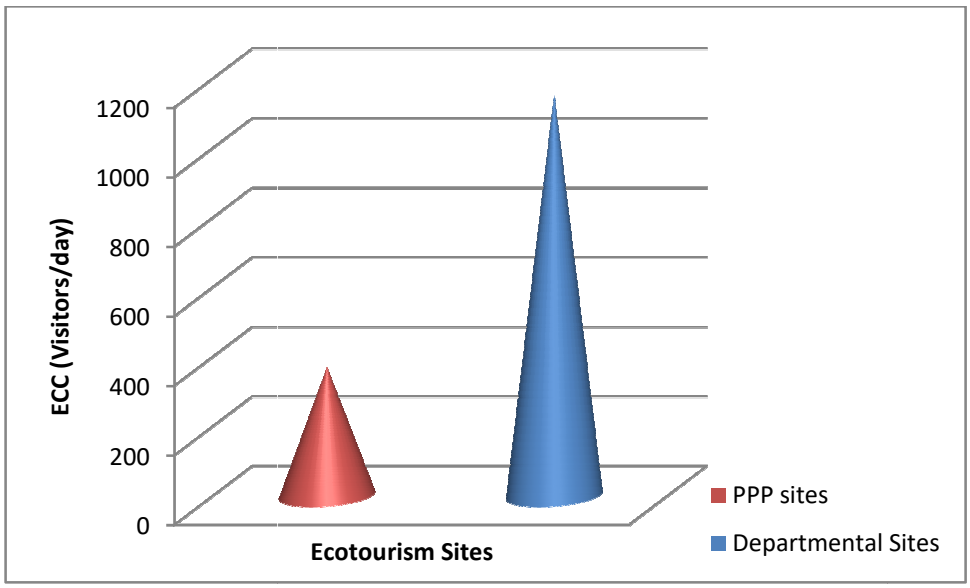


Fig. 4.37: Site wise ECC status for ecotourism activities

At Departmental sites not only the availability of facilities and equipments are insufficient but also the staff is less and not trained enough to meet the tourists demand and sustain the ecotourism activities for long. Maldonado and Montagnini (2005), while calculating the TCC of La tigra National Park America found the ECC of 139,065 visitors^{-year}, 94% higher

than the current visitation at that time and showed that visitation can be increased, as long as there are increases in the management capacity as well. The management capacity was crucial in determining the ECC, and it is a useful indicator of the conditions of the infrastructure and equipment available at a site. Saveriades (2000) also stated that carrying capacity of any region is not fixed it develops with time and the growth of tourism, and can be affected by management techniques and controls. Bhardwaj *et al.*, (2019) and Lagmoj *et al.*, (2013) have also mentioned that effective carrying capacity can be improved through suitable planning to provide the required infrastructures, facilities and services and skilled manpower.

Departmental sites have a much wider scope of improvement and accommodating more tourists than the PPP sites (Fig. 4.37). Overall the carrying capacity assessment of all the ecotourism sites indicated that the ecotourism activities in the study area are still within the carrying capacity limit at present and thus are sustainable with the current management system so, the findings indicated that each component was in its healthiest state and low impact on carrying capacity category. The results are in line with the findings of Romadhon *et al.*, (2014), who concluded that ecotourism activities in Sapeken archipelago, Indonesia are sustainable on account of regional carrying capacity being greater than the equivalence factor including land, forest and available area. Sharma (2016) in carrying capacity studies of Kerwa in Madhya Pradesh also illustrated that the carrying capacity in the region is still sustainable due to the low impact of tourism activities.

4.1.3 WATER QUALITY STATUS OF ECOTOURISM SITES

The status of water quality for PPP and Departmental sites is presented in table 4.7 and 4.8. All the water quality parameters were found within the permissible limits.

Water pH

In the study area, pH of water sources ranged from 7.07 to 7.72 for PPP sites and 7.10 to 7.61 for Departmental sites which fall in the normal range as prescribed by WHO and CPCB standards. Highest pH of 7.72 was noticed in Nature Camp (Narkanda) followed by Himalyan Nature Camp (Jalodi) > Aamod (Dalhousie) > Nature's Treat (Khalogra) > Pine Hills Eco-Camp (Chewa) > Nature Camp (Sanawar) > Park Woods (Aanji) > Aamod (Shoghi), with respective

values of 7.66, 7.54, 7.44, 7.37, 7.23, 7.19 and 7.11. At Departmental sites however, as depicted in table 4.8 the sites were found in the order of Ecotourism site, (Devidarh) > Ecotourism site (Sahoo) > Ecotourism site (Kasol) > Children's Park (Hamirpur) > Ecotourism site (Paneo) > Ecotourism site (Prashar) > Ecotourism site (Holi) > Nature Park (Jhiri) with pH 7.61, 7.59, 7.56, 7.46, 7.36, 7.26, 7.24 and 7.21 respectively for water pH. The variation recorded in the pH of different sites may be because of the inherent geological property of the water in the region.

Water Electrical Conductivity

The data indicated in table 4.7 shows that the EC of water sources in the study area for PPP sites ranged from 0.24 dSm^{-1} to 0.56 dSm^{-1} and 0.29 dSm^{-1} to 0.66 dSm^{-1} for Departmental sites, which was in the normal range as prescribed by WHO and CPCB standards. The highest water EC was observed at Nature Camp (Narkanda) followed by Aamod (Shoghi) > Aamod (Dalhousie) > Himalyan Nature Camp (Jalodi) > Nature Camp (Sanawar), Pine Hills Eco-Camp (Chewa), Park Woods (Aanji) and Nature's Treat (Khalogra) with respective values of 0.56 dSm^{-1}, 0.53 dSm^{-1}, 0.47 dSm^{-1}, 0.44 dSm^{-1}, 0.38 dSm^{-1}, 0.32 dSm^{-1}, 0.28 dSm^{-1} and 0.25 dSm^{-1}. For Departmental sites however the highest EC was found for Ecotourism site (Devidarh) with a value of 0.66 dSm^{-1} this site is followed by Children's Park (Hamirpur) > Nature Park (Jhiri) > Ecotourism site (Holi) > Ecotourism site (Paneo) > Ecotourism site (Sahoo) > Ecotourism site (Prashar) with EC 0.59 dSm^{-1}, 0.56 dSm^{-1}, 0.49 dSm^{-1}, 0.43 dSm^{-1}, 0.36 dSm^{-1}, 0.32 dSm^{-1} respectively. The Departmental site with least EC is Ecotourism site (Kasol) with a value of 0.29 dSm^{-1}. This could be attributed to the origin of water source which is ground water, the ions in the water could be due to its contact with rocks.

Table 4.7: Status of water quality parameters of PPP ecotourism sites

Ecotourism Sites	pH	EC (dSm^{-1})	TDS (mgl^{-1})	BOD (mgl^{-1})
Aamod, Shoghi	7.07	0.53	298.76	1.89
Nature's Treat, Khalogra	7.44	0.25	285.36	0.81
Park Woods, Aanji	7.09	0.28	233.12	2.23
Pine Hills Eco Camp, Chewa	7.37	0.32	240.28	1.51
Nature Camp, Sanawar	7.23	0.38	246.27	1.76
Aamod, Dalhousie	7.54	0.47	276.54	1.99
Nature Camp, Narkanda	7.72	0.56	258.78	2.19
Himalyan Nature Camp, Jalodi	7.66	0.44	262.43	2.56

Total Dissolved Solids

The Total Dissolved Solids (TDS) of the water sources in the region ranged from 233.12 mgl^{-1} to 298.76 mgl^{-1} for PPP sites and 238.46 mgl^{-1} to 292.12 mgl^{-1} for Departmental sites which was in the normal range as prescribed by WHO and CPCB standards. Highest TDS of 298.76 mgl^{-1} was observed for Aamod (Shoghi) followed by Nature's Treat (Khalogra) > Aamod (Dalhousie) > Himalayan Nature Camp (Jalodi) > Nature Camp (Narkanda) > Nature Camp (Sanawar) > Pine Hills Eco-Camp (Chewa) > Park Woods (Aanji) with respective TDS of 285.36 mgl^{-1}, 276.54 mgl^{-1}, 262.43 mgl^{-1}, 258.78 mgl^{-1}, 246.27 mgl^{-1}, 240.28 mgl^{-1} and 233.12 mgl^{-1}. For Departmental sites on the other hand the TDS was recorded in the order of Ecotourism site (Devidarh) > Ecotourism site (Kasol) > Ecotourism site (Sahoo) > Ecotourism site (Paneo) > Ecotourism site (Prashar) > Children's Park (Hamirpur) > Ecotourism site (Holi) > Nature Park (Jhiri) with TDS of 292.12 mgl^{-1}, 285.24 mgl^{-1}, 280.32 mgl^{-1}, 273.28 mgl^{-1}, 268.31 mgl^{-1}, 256.16 mgl^{-1}, 243.26 mgl^{-1}, 238.46 mgl^{-1} respectively. More TDS in the water sources at certain sites can be attributed to the origin of water source which is ground water, the dissolved solids in the water could be due to its contact with underground rocks.

Table 4.8: Status of water quality parameters of Departmental ecotourism sites

Ecotourism Sites	pH	EC(dSm^{-1})	TDS (mgl^{-1})	BOD (mgl^{-1})
Ecotourism site, Kasol	7.56	0.29	285.24	1.93
Ecotourism site, Devidarh	7.61	0.66	292.12	2.21
Ecotourism site, Prashar	7.26	0.32	268.31	2.62
Children's Park, Hamirpur	7.46	0.59	256.16	1.77
Ecotourism site, Holi	7.24	0.49	243.26	1.52
Ecotourism site, Sahoo	7.59	0.36	280.32	1.64
Ecotourism site, Paneo	7.36	0.43	273.28	2.15
Nature Park, Jhiri	7.21	0.56	238.46	1.06

Biological Oxygen Demand

The Biological Oxygen Demand (BOD) of the water sources for PPP sites in the region in the region ranged from 0.81 mgl^{-1} to 2.56 mgl^{-1} and from 1.06 mgl^{-1} to 2.62 mgl^{-1} for PPP and Departmental sites respectively, which was in normal range as prescribed by WHO and CPCB standards. The water sources in the ecotourism sites did not vary statistically. For PPP sites the BOD was observed in the order of Himalayan Nature Camp (Jalodi) > Park Woods (Aanji) >

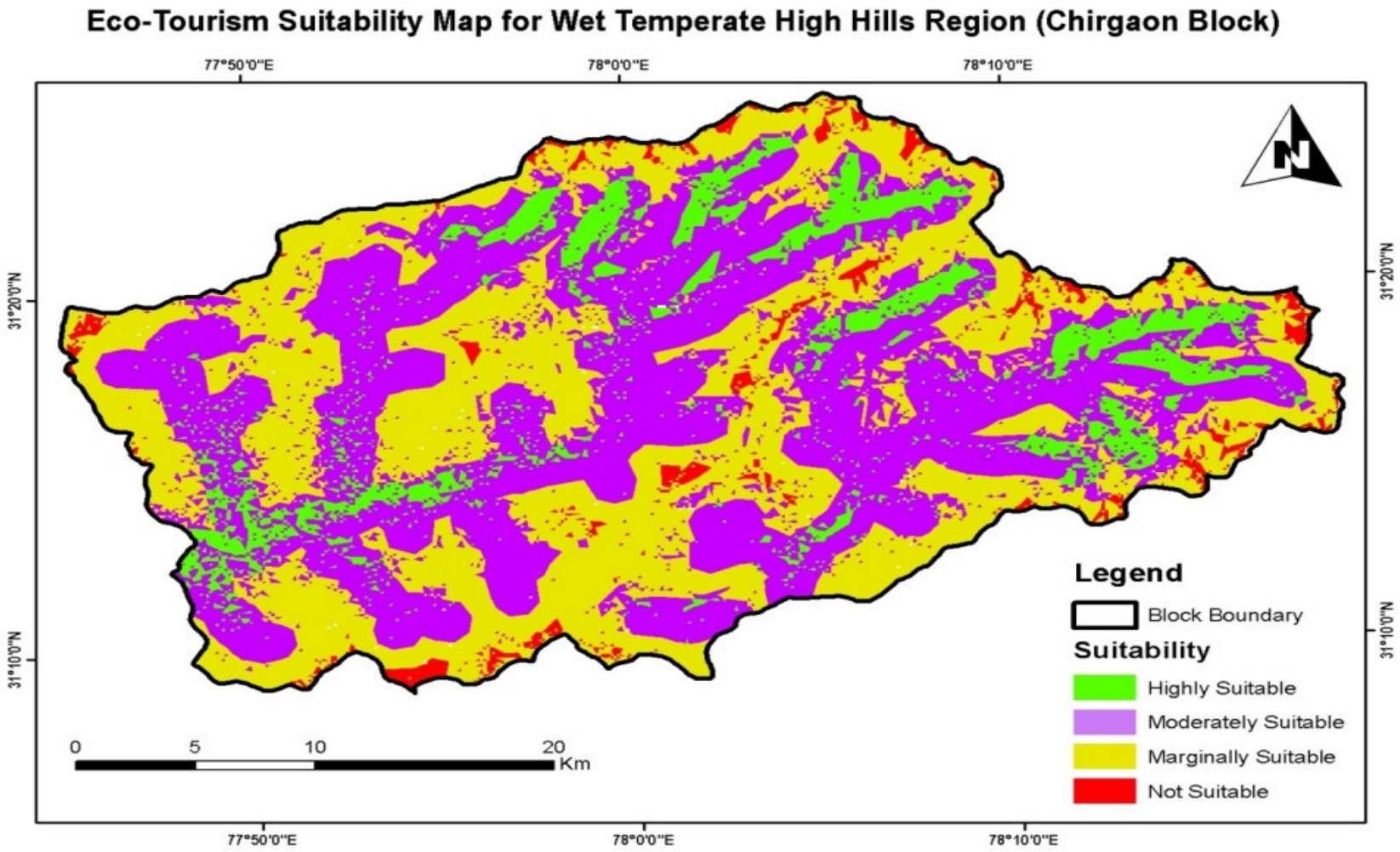
Nature Camp (Narkanda) > Aamod (Dalhousie) > Aamod (Shoghi) > Nature Camp (Sanawar) > Pine Hills Eco-Camp (Chewa) > Nature's Treat (Khalogra) with the BOD of 2.56 mgl^{-1}, 2.23 mgl^{-1}, 2.19 mgl^{-1}, 1.99 mgl^{-1}, 1.89 mgl^{-1}, 1.76 mgl^{-1}, 1.51 mgl^{-1} and 0.81 mgl^{-1} respectively. For Departmental sites however the BOD was observed in the order of Ecotourism site (Prashar) > Ecotourism site (Devidarh) > Ecotourism site (Paneo) > Ecotourism site (Kasol) > Children's Park (Hamirpur) > Ecotourism site (Sahoo) > Ecotourism site (Holi) > Nature Park (Jhiri) with respective BOD of 2.62 mgl^{-1}, 2.21 mgl^{-1}, 2.15 mgl^{-1}, 1.93 mgl^{-1}, 1.77 mgl^{-1}, 1.64 mgl^{-1}, 1.52 mgl^{-1} and 1.46 mgl^{-1}. Higher BOD was recorded at certain sites this may be due to foreign material such as waste which is often used in agricultural fields as manure in the nearby village areas. It can be concluded from the assessment and data obtained that presently the ecotourism activities are not impacting the quality of the nearby water sources. This finding can be attributed to the reason that tourist flow is not beyond the carrying capacity limits of the area. These findings are in confirmation with the findings of Raveen *et al*. (2008).

4.3 DELINEATION OF ECOTOURISM POTENTIAL AREA

In Himachal Pradesh ecotourism potential areas were delineated based on the selected criteria and by applying the AHP, GIS and remote sensing technique and the results obtained have been presented in table 4.9, 4.10, 4.11, 4.12, 4.13 and 4.14. The block wise areas delineated and their degree of suitability has been described under the following heads:

4.3.1 Potential Ecotourism Area in Chirgaun Block

Chirgaun block of Shimla district covers an area of 989.78 km^2 and falls under Wet Temperate High Hill Region of Himachal Pradesh, the area of the block under different suitability class is tabulated in table 4.6. The data indicated that in this region the highest percentage of area i.e. 44.42% (439.63km^2) was under the marginal suitability (S3) class for ecotourism, followed by moderately suitable (42.02%) and not suitable region (10.51%) with respective area of around 415.93 km^2 and 104.04 km^2 respectively. The area under highly suitable class (S1) was only 3.05% (30.18 km^2) out of the total area of the block. Map 4.1 shows the suitability class distribution on the Chirgaun block map extracted from the block map of Himachal Pradesh using ArcGIS software. Highly suitable region is mostly available in the north-eastern part of the block and is depicted by green color as can be observed from map 4.1



Map 4.1: Ecotourism suitability map of Chirgaun Block

depicted by green color and some region is also available in the south-western part. The other three suitability classes i.e. S2, S3 and S4 are depicted by purple, yellow and red color respectively.

Table 4.9: Ecotourism suitability classification for Chirgaun Block

Suitability Class	Area (km^2)	Percent area (%)
High (S1)	30.18	3.05
Moderate (S2)	415.93	42.02
Marginal (S3)	439.63	44.42
Not Suitable (S4)	104.04	10.51

4.3.2 Potential Ecotourism Area in Kalpa Block

Kalpa block of Kinnaur district covers an area of 1813.13 km^2 and falls under Dry temperate region of Himachal Pradesh was also considered for the study. The distribution of block area into various suitability classes is shown in table 4.10. The area under the suitability class was found in the order of marginally suitable (47.6%) > moderately suitable (42.8%) > highly suitable (8.6%) > not suitable area (1%), with respective areas 863.62 km^2, 775.54 km^2, 155.22 km^2 > 18.75 km^2. The highly suitable area is mostly scattered along the drainage in the central part of the block as can be observed from Map 4.2, depicted by green color.

Table 4.10: Ecotourism suitability classification for Kalpa Block

Suitability Class	Area (km^2)	Percent Area
High (S1)	155.22	8.6
Moderate (S2)	775.54	42.8
Marginal (S3)	863.62	47.6
Not Suitable (S4)	18.75	1.0

4.3.3 Potential Ecotourism Area in Seraj Block

Next block undertaken for site suitability analysis for potential ecotourism area is Seraj in Mandi district of Himachal Pradesh falling under wet temperate high hill region of the state. Total area of block (473.4 km^2) is distributed under the four classes which is tabulated and presented in table 4.13. Out of the total area, only 7.56 % (35.79 km^2) was found highly suitable for the purpose of ecotourism development. Highest area was found to fall under moderately suitable (S2) class i.e. 52.90% (250.45 km^2), followed by marginally suitable (S3) class with

percentage area of about 36.81% (174.25 km^2), while 2.73% (12.91 km^2) of the total area was found to fall under not suitable (S4) category. The block map of Seraj is categorized to represent 4 suitability classes (S1, S2, S3 and S4) as depicted in Map 4.3.

Table 4.11: Ecotourism suitability classification for Seraj Block

Suitability Class	Area (km^2)	Percent Area
High (S1)	35.79	7.56
Moderate (S2)	250.45	52.90
Marginal (S3)	174.25	36.81
Not Suitable (S4)	12.91	2.73

4.3.4 Potential Ecotourism Area in Bharmaur Block

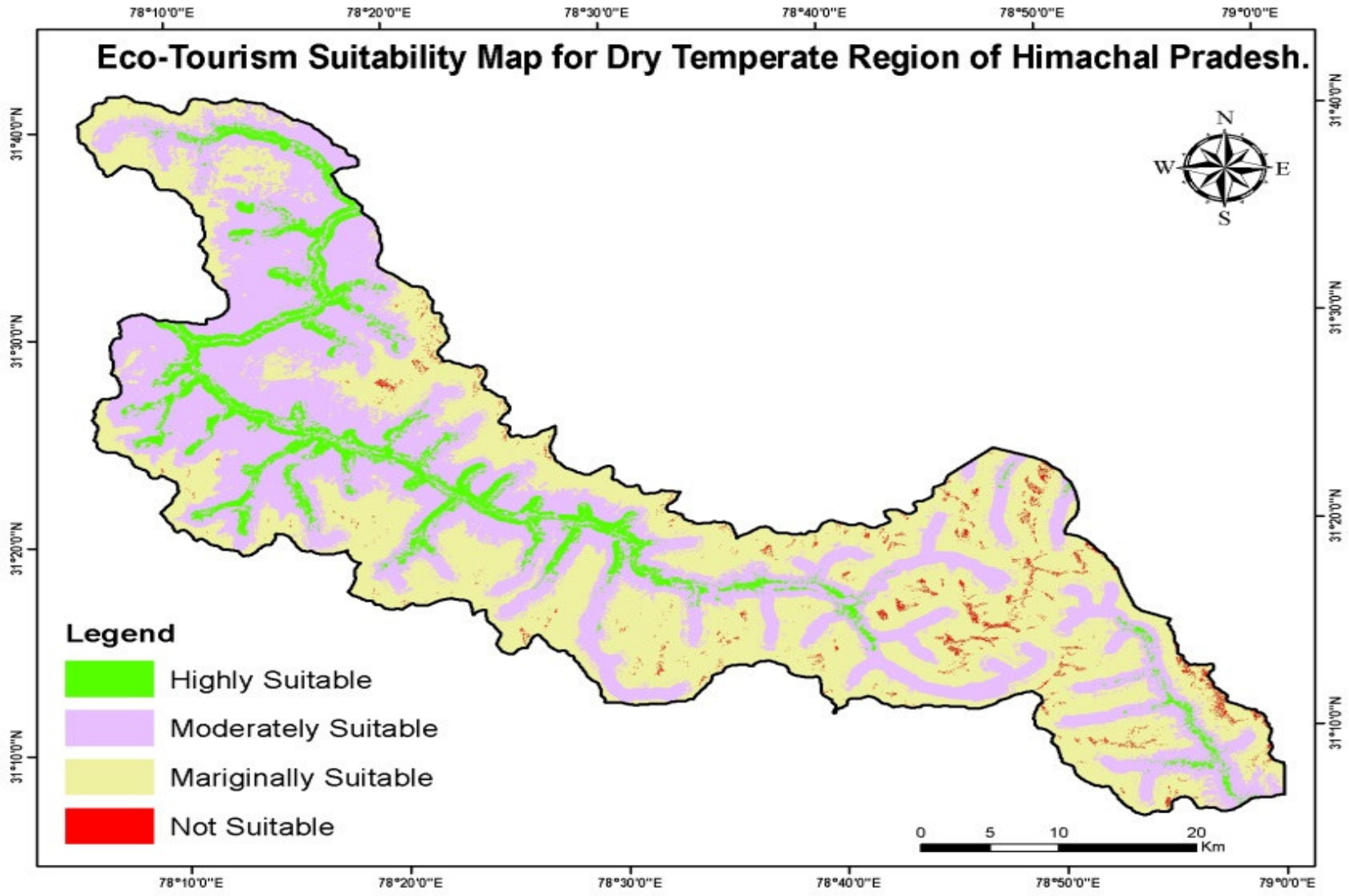
For identifying new potential ecotourism sites Bharmaur block of Chamba district falling under dry temperate high hill region of Himachal Pradesh was also analyzed. The results obtained are depicted in table 4.11 the following order was obtained, marginally suitable (55.44%) > moderately suitable (29.32%) > not suitable (9.05%) > highly suitable (6.19%) with areas 917.48 km^2, 485.27 km^2, 149.76km^2 and 102.45 km^2 respectively. The distribution of the four suitability classes in the block area is depicted in Map 4.4.

Table 4.12: Ecotourism suitability classification for Bharmaur Block

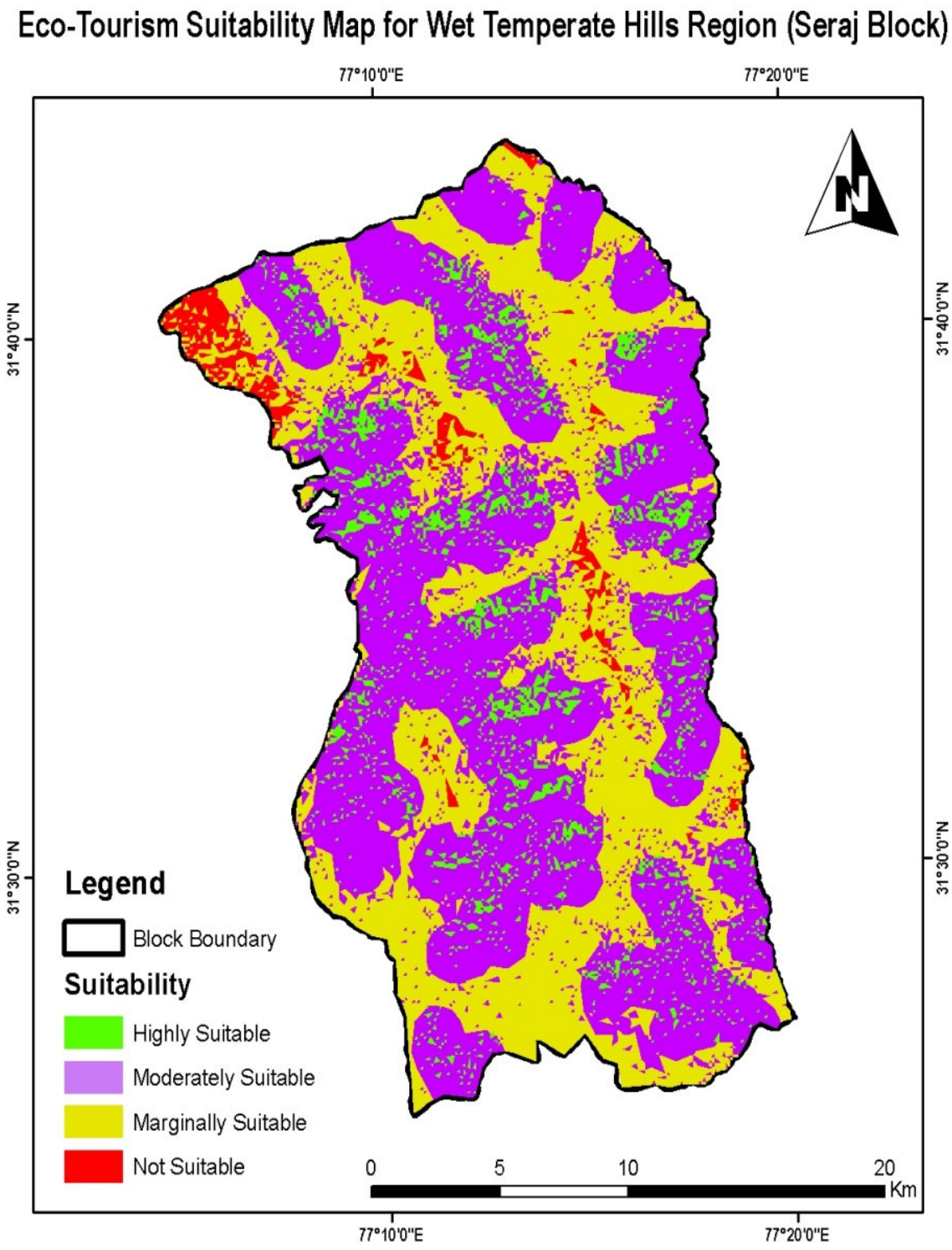
Suitability Class	Area (km^2)	Percent Area
High (S1)	102.45	6.19
Moderate (S2)	485.27	29.32
Marginal (S3)	917.48	55.44
Not Suitable (S4)	149.76	9.05

4.3.5 Potential Ecotourism Area in Sangrah Block

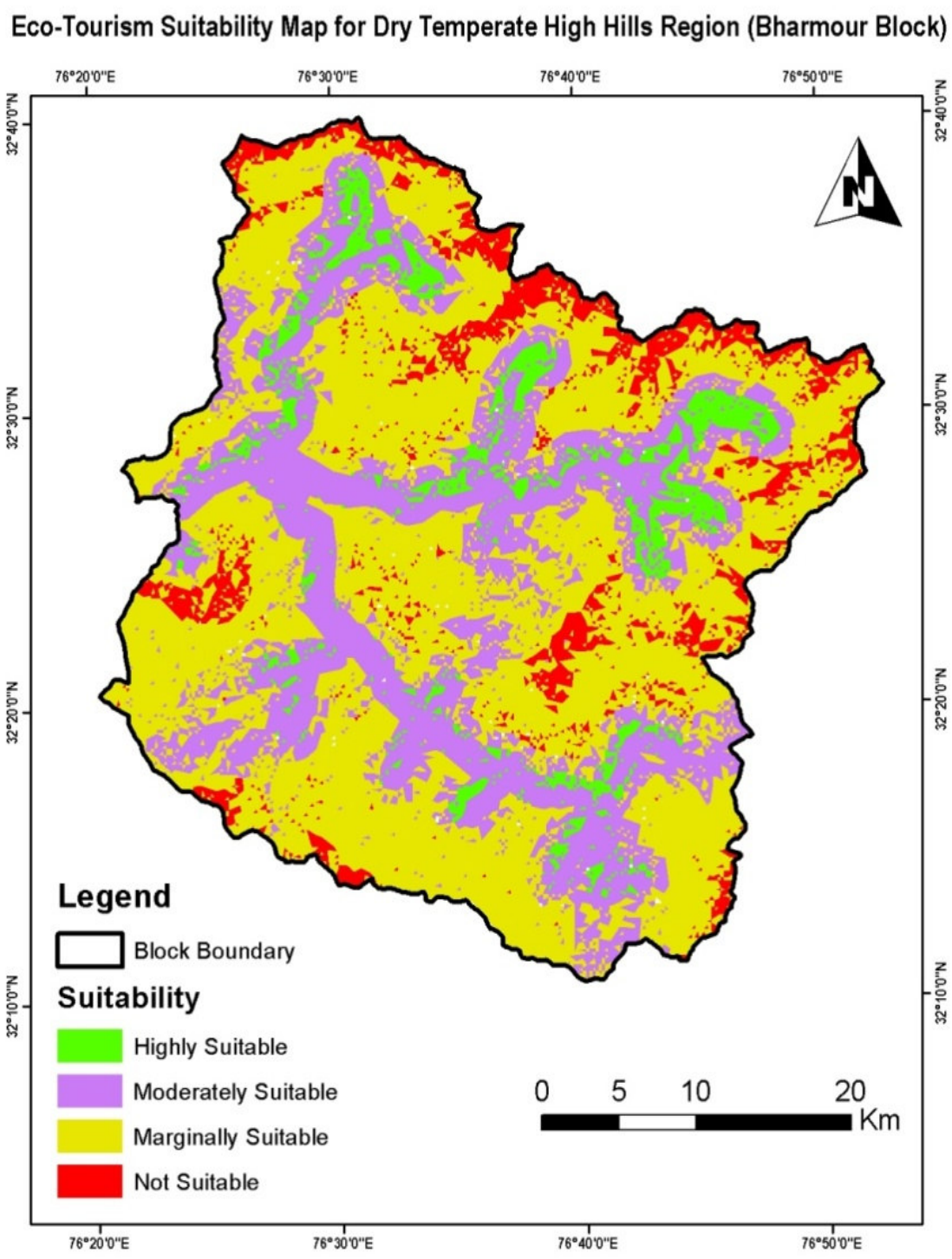
Similarly, the results were obtained for Sangrah block of Sirmaur district of Himachal Pradesh that falls in the sub-humid mid hill region of the state. The total area of this block is 478.65 km^2. Maximum percentage area i.e. 57.55% (275.47km^2) is categorized under moderately suitable (S2) class following by marginally (27.13%) and highly suitable (11.16%) with 129.85 km^2 and 53.41 km^2 area respectively. Least percentage area 4.16% (19.92 km^2) was found under



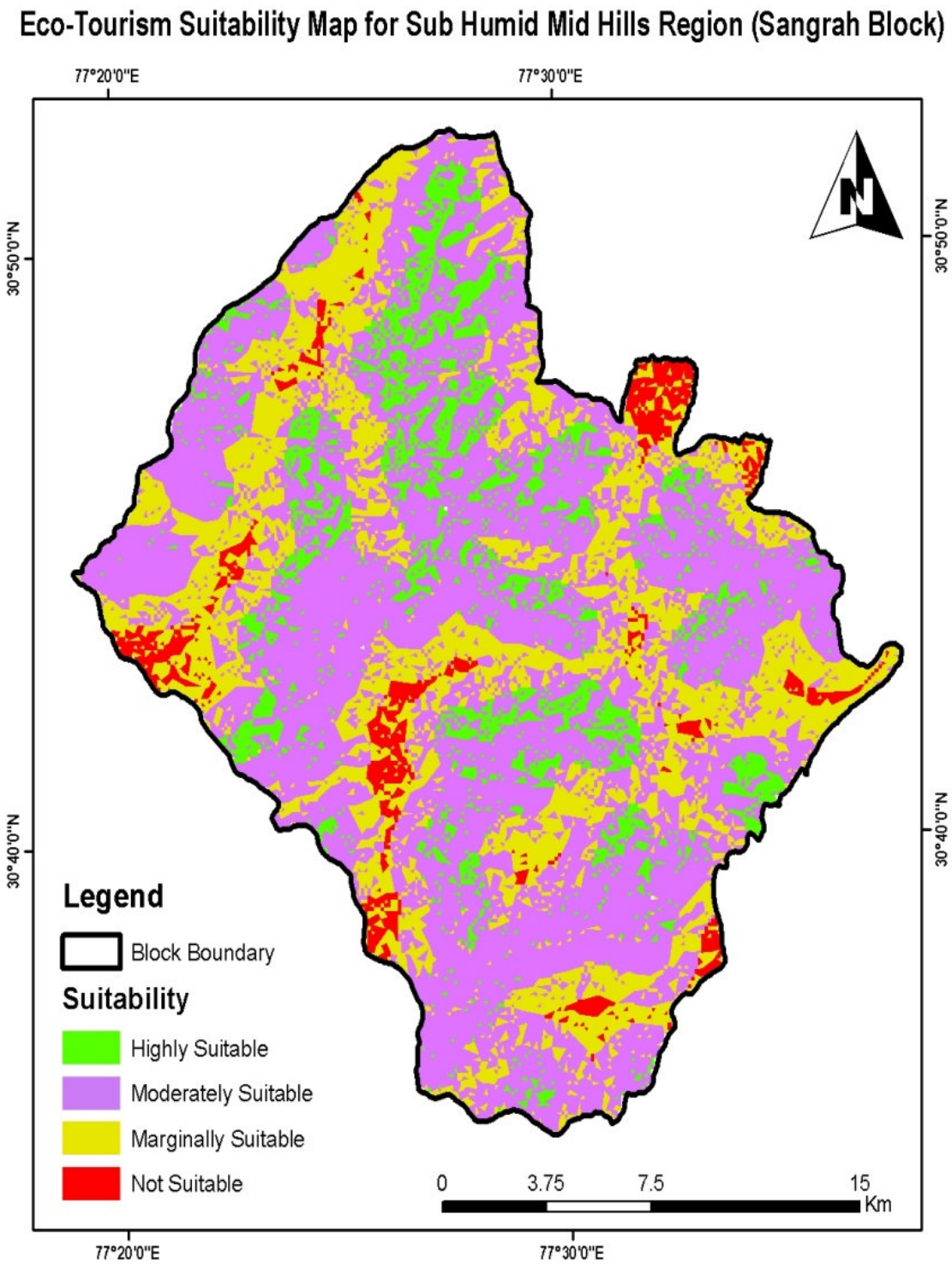
Map 4.2: Ecotourism suitability map of Kalpa Block



Map 4.3: Ecotourism suitability map of Seraj Block



Map 4.4: Ecotourism suitability map of Bharmour Block



Map 4.5: Ecotourism suitability map of Sangrah Block

not suitable (S4) class for ecotourism purpose. Total block area distribution under all the four suitability classes can be seen in map 4.4.

Table 4.13: Ecotourism suitability classification for Sangrah Block

Suitability Class	Area (km^2)	Percent Area
Highly (S1)	53.41	11.16
Moderate (S2)	275.47	57.55
Marginal (S3)	129.85	27.13
Not Suitable (S4)	19.92	4.16

Amongst the study blocks, Sangrah block of district Sirmaur was found to have maximum area under highly suitable (S1) class i.e. 11.16%. Following Sangrah the other blocks were in found in the order of Kalpa (8.6%) > Seraj (7.56%) > Bharmaur (6.19%) respectively Whereas, the block with the least percentage of area under highly suitable class is Chirgaun block of Shimla district with only 3.05% area falling in this category. It may also be concluded that with proper field verification and well planned developmental strategy the selected regions can be developed into an ecotourism site. The study can be replicated for other blocks as well and finally the state can be developed as an ecotourism hub. Suryabhagavan *et al.* (2015) have also found similar results for Hawassa town and its surroundings with high ecotourism potential due to the presence of abundant natural and cultural resources including landscape.

4.3.6 Details of Suitability Classes

The total area of the selected blocks was divided into the four suitability classes i.e. S1, S2, S3 and S4. Similar, land evaluation classes were given by the FAO framework for land evaluation and are used by various authors for similar studies (Suryabhagavan *et al.* 2015 and Tienwong, 2008). Applicable criteria with sub-classes, rating and suitability classification considered for the purpose varied for some blocks according to the presence of various features/conditions which are explained under each suitability class as under:

Highly Suitable (S1) Class

The highly suitable areas include the region with the topographical features including slope less than 15^o, falling under southern aspect and with elevation ranging between 1500 –

3000m for Chirgaun and Bharmaur block; 1700 – 3600m for Kalpa block and more than 2000m for Seraj and Sangrah block. In addition, some perennial water source lie at a distance of less than 1km far and the nearest road for accessibility is within 2km distance (Chirgaun, Kalpa and Bharmaur) and within 1.5km for Seraj and Sangrah block from the potential area identified for setting an ecotourism site. The area covered under this category falls under grassland category of LULC class. The population in the nearby region is less than 100 and for tourist facilitation some tourist spot fall within 5km range around the identified highly suitable (S1) site. The area found under this class has the highest capability that after field verification and planning can be developed into an ecotourism site.

Moderately Suitable (S2) Class

The moderately suitable class for ecotourism in the study area included the area having slope between 15 – 25^{o}, falling under eastern aspect and an elevation of 3000 – 4000m for Chirgaun and Bharmaur; 3600 – 4000m for Kalpa block and 1500 – 2000m for Seraj and Sangrah blocks. The distance of the nearest water source is between 1km – 1.5km for Chirgaun, Seraj, Bharmaur and Sangrah block while it is 500m – 1km for Kalpa block. The nearest road is not more than 2 – 3km far for Chirgaun, Kalpa and Bharmaur on the other hand it is within 1 – 1.5 km for Seraj and Sangrah block. LULC class falls under forest category and the nearby population is within the range of 100 - 300 people with a tourist spot situated around 5 – 10km around the area. A detailed assessment is required in these regions and only by proper facilitation and ecotourism services these area can be developed into ecotourism sites.

Marginally Suitable (S3) Class

Area classified as marginally suitable for ecotourism accounted for the region falling in western aspect, slope ranging within 25 – 40^{o} and elevation between 4000 – 4500m for Chirgaun, Bharmaur and Kapla block and 1200 – 1500m for Seraj and Sangrah block. Perennial water source is within 1.5 – 2km periphery and the area lies in LULC class including horticulture and barren/rocky area. The nearest road is around 3 – 5 km far in Chirgaun, Kalpa and Bharmaur block while it is 0.5 – 1km far in Seraj and Sangrah block. The number of people within the area is within 300 - 500 persons and some tourist destination is situated within 15km. The area falling

under this class allows for the development of ecotourism activity, but with high consideration for the resource and features available for ecotourism purpose and development.

Not Suitable (S4) Class

The area under not suitable class for ecotourism constituted of area with topographical feature having slope more than 40^{o} falling under northern aspect and elevation range of more than 4500m for Chirgaun and Kalpa block; 1282 – 1500m and more than 4500m for Bharmaur block; 886 – 1200m for Seraj and 586 – 1200m for Sangrah block. The water source is more than 2km apart from the place and the area falling under LULC class having snow, glacier, agriculture, water body and buildup area is also categorized under this class and is not suitable for ecotourism purpose. The area with no road accessibility within 5km in Chirgaun, Kalpa and Bharmaur block; and within 0.5km for Seraj and Sangrah block is also categorized in this class. The area under this class has population of more than 500 people and no tourist spot lies within 15km periphery of this region. The area with above mentioned features is not at all favorable for setting an ecotourism site and thus should not be considered for the purpose.

Similar results have been found by various authors regionally and globally by considering the factors/attributes of suitability taken into account for this study as well, including slope (Samanta and Baitalik, 2015; Chhetri and Arrowsmith, 2008; Bunruamkaew and Murayam, 2011; Suryabhagavan *et al.* 2015 and Aklibasinda and Bulut 2014), elevation (Samanta and Baitalik, 2015; Chhetri and Arrowsmith, 2008; Bunruamkaew *et al.* 2015; Nahuelhual *et al.* 2013; Aklibasinda and Bulut 2014 and Nino *et al.* 2017), aspect (Bali *et al.* 2015 and Mahini *et al.* 2010). Distance to water source has also been considered by various authors and was found as an effective criterion (Samanta and Baitalik, 2015; Chhetri and Arrowsmith 2008; Bunruamkaew and Murayam 2011). Distance to roads for accessibility (Nahuelhual *et al.* 2013; Samanta and Baitalik 2015 and Aklibasinda and Bulut 2014), land use land cover (Samanta and Baitalik, 2015; Chhetri and Arrowsmith 2008 and Nino *et al.* 2017) and proximity to cultural heritage sites (Bunruamkaew and Murayam 2011; Suryabhagavan *et al.* 2015 and Siroosi *et al.*, 2020) are also widely considered for the purpose of ecotourism suitability.

It is also concluded from the study that remote sensing and GIS along with AHP technique can prove to be a promising technique for the identification of potential ecotourism sites that can save both time and labor. Similar results were obtained by Bunruamkaew and Murayama, (2011) who have identified and prioritized the potential ecotourism sites using GIS and AHP in Surat Thani Province Thailand, by linking the criteria deemed important with the actual resources available in the study area. Suryabhagavan *et al.* (2015) have also mentioned in a similar study for Ethiopia that remote sensing and GIS tools are useful in analyzing and establishing tourism potential especially ecotourism development. According to Jafar and Delavar (2010) also a meaningful relationship is established among tourism activities with the help of remote sensing and GIS technique. Azizur (2010) has ascertained in a study of ecotourism development in Sunderbans of Bangladesh that GIS is a valuable tool for investigating criteria that relate to ecotourism development including location, condition, resources use. Bhaya and Chakraabarty (2016) have also recognized the ecotourism sites by integrating spatial and non-spatial data by adopting GIS approach of visualization as an innovative discipline to recognize suitable ecotourism areas in Jungle Mahal area of West Bengal. Mohd and Ujang (2016) have also concluded that GIS based AHP is a strong and effective tool in ecotourism planning.

The following conclusions can also be drawn from the study that in addition to the already developed and well-known tourist attraction places in Himachal Pradesh, the state has more pristine areas where the sustainable form of tourism called ecotourism can be developed. This can not only help in minimizing pressure on the natural resources of the state but can also help in an even distribution of heavy tourist inflow as well as socio-economic development of the other localized mountain communities residing in the state. Obadiah *et al.* (2012) has also concluded that ecotourism has a low negative visitor impact on the environment of an area. Development of new potential ecotourism sites will further help in restricting the expansion of concrete structures rather will promote multi-sectoral and more sustainable high productivity practices like agroforestry, agri-silvi-pastoral systems, horticulture, sericulture, aquaculture, animal husbandry, etc., amongst the rural communities as these activities will help in sustaining the ecotourism activities in a region. Similar conclusions has been put forth by Bhaya and Chakrabarty (2016) mentioning that apart from planning for ecotourism infrastructure, ideas will

be gained for afforestation and other forest based economic activities that will meet the demand of tourists as well as the local people. Suryabhagavan *et al.* (2015) have also concluded in a study that the mainstream idea of ecotourism fits for sustainable development of a region and for the development of local people.

4.3. STRATEGIC FRAMEWORK FOR SUSTAINABLE ECOTOURISM DEVELOPMENT USING SWOT TECHNIQUE

The survey revealed that the state has great scope for ecotourism development on the basis of scenic beauty emerged through its vast natural resource base. So, to ensure the establishment and development of this eco-friendly sector in harmony with nature and to make it more sustainable, a planned strategy is required. Analysis of primary and secondary data collected through survey, interviews and observation using SWOT techniquewas used for developing a strategic frameworkfor sustainable ecotourism development in Himachal Pradesh. Firstly, a brief regarding the strengths, weaknesses, opportunities and threats of the ecotourism industry and the features of the state related to the activity have been presented and described below:

Strengths

The analysis shows that the ecotourism activities in the state have enormous strength for sustainable development in addition to the existing productive growth being observed. Major strength that were noticed and stated by the respondents during the survey are as follows:

- Himachal Pradesh is a well established tourism destination that is famous not only amongst the tourists of the neighboring states but also amongst the visitors from other states and countries. The increasing tourist inflow since many years with a positive CAGR of 8.3% (Fig 3.1) is indicative of established tourism destinations in the state.
- The state has a well developed existing tourism market in different types of tourism may it be religious, cultural, natural, recreational, adventure or wellness tourism. Himachal is a state of religious importance, fair and festivals in addition to high historic and cultural diversity.

- Understanding the importance of the contribution that tourism sector has in state's economy and at the same time to ensure the management of the natural resources in the region, the state government has formulated its own Ecotourism Policy in 2005 that is re-revised in 2017. Under the policy the State Forest department has taken initiatives for green destinationsby leasing out around 8 sites to the private firms to be operated as the ecotourism sites and around 22 sites are being operated by the department itself. The department has also planned the development of ecotourism through forming the ecotourism circuits in the state.
- The ecotourism activities being already operated in the state are presently sustainable as concluded in the results for the first objective of present study. The sites are also still within the carrying capacity limits, as concluded in the carrying capacity determination of the existing sites.
- Most regions in Himachal Pradesh haveclean, green and safe environment along with comfortable weather (soft summers and cold spring) and climatic conditions for most part of the year. Reduced water and air pollution levels in rural as well as majority of urban areas further gives an edge to the state for ecotourism development.Geographical location (nearby source of tourists including Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Gujarat) and nonexistence of excessive urbanizationin the state further strengthens the scope of more tourist inflow.
- The state is bestowed with a variety of natural attractions, unique and appropriate terrain and topography that makes many regions suitable for variety of ecotourism related activities (paragliding, hiking, nature walk, rock climbing, river rafting, etc.).
- The state has an adventure sports training institute called the **Atal Bihari Vajpayee Institute of Mountaineering and Allied Sports, (ABVIMAS)**at Manali, Kullu District of Himachal Pradesh.
- There is a vast network of protected areas (5 national parks, 26 wildlife sanctuaries and 3 conservation reserves)in the state that can be used for ecotourism purpose.
- The state is bestowed with unique ecosystems, high biodiversity, valuable wildlife, vast geography and ample natural resources to support the ecotourism venture. In addition, variety and ethnic richness in indigenous areas with traditional cuisine and regional

specialties (art and craft) further supports suitability. The existence of unique culture (traditions, folk music and dance) ancient and historic ruins (Chamba handkerchief and footwear, Kullu shawl)andreligious pilgrimageadds to the strength of the state for the purpose.

- Local communities in most of the regions strongly supports tourism and are in favor of ecotourism in the region as good number of domestic as well as foreign tourists visit the ecotourism and other conventional tourism destinations, as concluded from the response received during interviews of the local villagers. Tourism acceptance at local level and the concept of "*AtithiDevoBhav*", strongly favors the development of ecotourism in the area.And already much incentive is gained by the local people from tourism in terms of income generation.

Delavar *et al*. (2010) has also concluded that in recent years, the eco-tourism sector, as a subset of tourism industry is playing a great role in improving the economy of many countries and their people. Moreover, it preserves the natural, bioenvironmental and cultural values of those areas.Vishwanatha and Chandrashekara (2014) also summed up similar results in the SWOT analysis for evaluation of ecotourism and its types in Kodagu district of Karnataka and concluded similar type of strengths including natural scenery, clean environment, sufficient natural resources in the area.

Weakness

The analysis also highlighted the weaknesses of the ecotourism activities that exist andhinders the sustenance and development of the industry in the state. Major weaknesses are listed below:

- Insufficient ecotourism based infrastructures and other facilities for tourist engagement and facilitation were found to be the major weaknesses listed by the respondents especially at the departmental sites.
- During the survey it was observed that there is lack of awareness on environment management, conservation and judicious utilization of natural resources, amongst a lot of tourists and some locals as well.

- The lack of strategies that ensure the promotion and marketing of lesser known ecotourism destinations was another observed weakness. The tour and travel agencies and operators are mostly unaware of such concept and sites. This has lead to insufficient publicity and marketing of this nature based tourism activity. Insufficient market research for promoting ecotourism and targeting the potential tourists was also noticed.
- Respondents also highlighted that at the presently functioning ecotourism sites there is lack of coordination among the stakeholders involved in tourism and ecotourism activities. Lack of planning and effective implementation of the ecotourism policy and inadequate funding for conservation, scientific research, awareness and education in the region further weakens. Some respondents stated that there is also dearth of regular monitoring and inspection of the sites and the government is not putting much effort for enhancing public participation in ecotourism business.
- Though the local people at well established ecotourism regions are getting benefit from tourism activities but it is not from ecotourism but mass tourism. Further, at the existing sites there is lack of local participation in ecotourism planning andactivities. Most respondents also agreed that the local community members are not aware of the ecotourism activity going on in the area and there is insufficient communication amongst the communities and authorities. Insufficient innovations to gain the confidence of local communities and awareness towards this form of tourism is a major weakness requiring action for effective implementation of the ecotourism activities in any area.
- Ecotourism activities are seasonal in nature; this was concluded while interviewing the site staff especially at certain high altitude ecotourism destinations. They informed that due to heavy snow the tents gets damaged and dumped in the snow. So, the tourists visit only in the summer season thus creating unemployment during harsh winters.
- Due to absence of awareness amongst the tourists and insufficient marketing and publicity of ecotourism, there is uneven distribution of tourism i.e. the tourists mostly visits the well known destinations and this leads to less tourist flow to ecotourism sites.
- The results obtained in the previous objectives of the present study have also revealed that there exists uneven development and difference in approach for this concept atdifferentecotourism sites. PPP sites were found to be more sustainable and are

providing better facilities to the tourists while the Departmental sites on the other hand have less facilities and activities available. These differences create confusion regarding the idea of ecotourism not only amongst the tourists but also the stakeholders. Difference in the ranking obtained by sustainability indicators for different sites, indicated loopholes in the implementation of the policy and concept.

- It was also observed during the survey, interviews and management capacity determination, that most of the sites lacked trained staff, there wasabsence of trained tourist guides and technical equipments. Most of the staff were multipurpose workers and lacked formal training in ecotourism management. Only some staffs, those who were on the managerial posts were professionally trained and have a degree or diploma in Hotel management or related fields.
- At some destinations specially the Departmental sites the activities were lacking regular monitoring and inspection, due to which the accommodation and other facilities are not in very good condition at certain sites. The staff as well as the other respondents from the locality and offices also highlighted the lack of sufficient and periodic funding for managing the sites.
- Lack of scientific resource management and inefficient waste management system at some of the ecotourism sites and other tourism sites was observed as an important weakness that needs immediate action.
- India still needs to enhance its environmental sustainability in which the country is ranked 128th. Some other aspects of the tourism like infrastructure remain somewhat underdeveloped, for example, the nation has very few hotel rooms per capita by international comparison as reported by WEF(2019).

Armono *et al.*(2016) have also found same results for Baluran National Park, Indonesia that increasing number of visitors has led to increase in tourism related activities in the region; this on one hand has led to welfare of local communities but on the other hand is causing degradation. Yilmaz et al, (2013) have found similar results for an ecotourism region in Turkey.

Opportunities

During the study this new venture in the state was found to have numerous opportunities for developing the industry as a sustainable business. These opportunities can be harnessed to

develop the ecotourism sites in more nature and public friendly way. The most important opportunities recorded during survey are listed as follows:

- The most favorable opportunity observed during the survey is virgin ecosystem with abundance of natural heritage responsible for high potential for ecotourism in the state. More people these days are preferring low impact nature based tourism, specially the youth that are aware about the concept of environment conservation. Internationallyas well, the concepts of ecotourism, agro-tourism, rural tourism, adventure tourism is gaining high interest.
- State has more potential areas that can be developed as ecotourism sites after thorough survey and planning, as evident from the identified sites in some randomly selected blocks of the state under second objective of the present study.
- Government initiatives in the form of various policies to encourage nature based tourism as well as motivation of youths to adopt entrepreneurial startups including setting ecotourism sites. For example, at Prashar ecotourism site the State Forest Department has developed an ecotourism site and handed it over to the local youth group for operation. This initiative has not only promoted ecotourism activity in the area but also restricted the migration of youth to urban areas. Government has also started initiatives like "*NayiManjileNayiRahen*" for promoting tourism in the state.
- Increased positive response of many national and international firms to invest in nature based tourism industry is an opportunity for the expansion and development of the ecotourism industry in the state.
- It was also concluded through present study that the PPP sites are more sustainable and are offering much more facilities and activities to the visitors revealing the opportunity and scope for privatization in ecotourism sector.
- Analysis of collected data from the Department of Tourism and Civil Aviation shows that the rate of tourist inflow (Fig. 3.1) has been increasing for past many years; this can prove to be an opportunity to divert more visitors from mainstream tourism towards ecotourism industry.

- Online marketing modes like websites and social media platforms for publicity are gaining momentum and popularity amongst the masses for searching the tourism destinations.
- It was concluded during the survey that more and more number of local people are showing interest in ecotourism activity and admits that this business is not only financially beneficial but also nature friendly. The people further acknowledged that the idea of ecotourism can not only improve the economic status of the area but also ensure management and conservation of the locally available natural resources.Many areas in the state have tremendous potential for ecotourism development that can provide the much needed employment and economic growth.
- Diversification of ecotourism products which will help in retaining majority of the income generated with the local people and help in job creation directly benefiting the local community especially the women.Development of new ecotourism related products can also be considered by the stakeholders.
- The state has opportunity in the form of possibility to attract tourists by utilizing natural, adventurous, historical, cultural, spiritual and traditional inheritance in the region.
- The existence of the legislative framework which allows the conservation of the protected areas gives an opportunity to the ecotourism to develop in a sustainable and managed way.
- Inspiration through success stories of certain existing sites like Pine Hill Eco- Camp (Chewa) and Ecotourism site (Prashar) have proved to be a boon to the local communities by employment generation and improvement in local life quality. This creates an opportunity for other sites to follow the same model.
- The state has a vast network of protected areas (5 national parks, 26 wildlife sanctuaries and 3 conservation reserves) where scientifically planned ecotourism can be allowed.
- Use of modern technologies like digital payment system, GPS and other gazettes amongst visitors as well as the residents has been increasing and widely grown in the state.
- The Travel and Tourism Competitiveness Report 2019 ranks India 34th out of 140 countries, through its combination of rich natural and cultural resources including its natural (14th) and cultural resources (8th) (WEF, 2019), this can further boost the tourist inflow into the state, thus giving ecotourism industry to limelight.

Natural and cultural heritage of an areas have also been reported to be the opportunity for ecotourism by Pinar and Osman (2012) in the study it hasalso been revealed that the tourists want to see more of the natural and cultural resources, the change in the needs and pleasures of the people, decrease in the participation to mass and luxury tourism movements and the tourist's wish to have a holiday individually or in small groups in natural environments strengthens the need of ecotourism.Cultural heritage spots, sound environmental measures and employment generation were also found as the opportunities by Vishwanatha and Chandrashekara (2014) in a study of ecotourism in Karnataka.

Threats

During the study somethreats due to external sources were also figured, as listed below:

- The ecotourism sites and the area around them are prone to potential negative cultural and environmental impacts due to various activities. During the interviews many local people as well as staff members admitted that not all the tourists are eco-tourists, meaning that many visitors don't follow the rules and regulations of the site and sometimes create nuisance to the adjacent forest area in the form of waste disposal, noise and harm to other nearby natural resources. Wearing (2001) has also confirmed that neglect of conservation and quality of life issues threaten the very basis of local population as well as viability and sustainability of ecotourism. Jennifer *et al.* (2010) alsoconcluded that the increasing numbers of tourists bring with themselves a range of socio-cultural and environmental issues for host communities.
- During the survey, resource exploitation on the name of ecotourism was also observed at certain sites especially due to lack of scientific waste management and discomfort to the locals indicating environmental and socio-cultural degradation of the area, that necessitates the need of a strategic plan to prohibit the events leading to exploitation of any kind.
- Competition from main stream tourism industry and emerging competition from the states like Uttarakhand which is also adopting ecotourism approach, is a threat for the development and sustenance of the ecotourism industry in the study area. Peroff*et al.*

(2017) have also documented the difficulties that rural area tourism activities face when competing with the nearby established destinations.

- Other threats being faced by the ecotourism sector in the state are the climatic and weather threats including landslides, earthquake, cloud bursts, heavy snow, hailstorm, avalanche, etc.As per the BIS seismic zonation map, Himachal Pradesh falls in Zone IV and V,from seismicity point of view, the state which forms a part of North Western Himalayas is very sensitive. Five districts, namely Chamba (53.2%), Hamirpur (90.9%), Kangra (98.6%), Kullu (53.1%), Mandi (97.4%) have 53 - 98.6 percent of area liable to the severest design intensity of MSK earthquake(Medvedev–Sponheuer–Karnik scale) IX or more, the remaining area of these districts being liable to the next severe intensity VIII. Bilaspur (25.3%) and Una (37.0%) also have substantial area in MSK IX and rest in MSK VIII. The remaining districts are also liable to VIII intensity earthquake (ENVIS, 2021).
- Besides, the earthquake, Himachal Pradesh is also affected by landslides, avalanches, flash floods, floods, fires – domestic and wild, retreating glaciers and droughts. Monsoon season brings all the hazards associated with it such as cloud burst, flash floods, landslides etc, which causes huge loss of life and property every year. The current issue of climate change has further worsened the occurrence of these events.
- Pandemic like Covid-19 and other disease outbreaks are also the potential threats to the ecotourism industry in the state. According to Economic survey of HP Report, (2021) one of the hardest hit sectors by the Covid-19 pandemic was tourism all around the world; in Himachal Pradesh also the tourism sector saw a contraction of 81.33 per cent in foreign and domestic tourist arrivals in 2020 only.

Strategic framework for sustainable ecotourism development in the state

The state is bestowed with high biodiversity, vast geography and ample natural resources to support the ecotourismventure but, planned development is a necessity as evident by the stated strengths, opportunities, weaknesses and threats of the industry. The emerging ecotourism industry in Himachal Pradesh is facing challenges and developmental efforts, thus, it need strong planning and strategic framework for establishment, sustainable growth and promotion. In the light of the findings of the study;considering different aspects (ecological, social, cultural and

economical), observations made during the period ofthe survey, interviews and discussions made with locals, site staff, officials and experts in the field of assessment, the following strategies for sustainable development of ecotourism in the state on the basis of information collected and SWOT analysis have been put forward. The results are presented in the form of SO (Strength-Opportunity), ST(Strength-Threats), WO (Weakness-Opportunity) and WT (Weakness-Threats) strategies.

SO Strategies

Proposed opportunities available that fit well with the strengths possessed by the state and ongoing ecotourism activities for further improving the state of sustainability of the industry are stated as follows:

- Present position of ecotourism sustainability in the state can be maintained and enhanced by increasing the adoption of environment friendly measures for meeting energy demand and efficient resource management. This can be done for example bythe use of solar power for meeting electricity demand, rain water harvesting and watershed management for fulfilling water requirement, plantations for enhancing bio-capacity, adopting scientific waste management techniques to restrict pollution of any kind and increasing local community participation for meeting the socioeconomic objective of the ecotourism approach.
- The carrying capacity as assessed at existing ecotourism sites in this study revealed ECC (Fig. 4.35 and Fig. 4.36) that can be harnessed to attract more tourists towards ecotourism sites through planned promotion and marketing.
- As most of the people these days prefer low impact nature based tourism this preference of the visitors can be utilized to further expand the ecotourism industry in the state taking the advantage of the natural serenity, climatic conditions and geographical location of the state. This can be done by establishing and developing newly identified potential ecotourism areas (Map 4.1 – Map 4.5) in the present study using remote sensing and GIS as well as more sites can be identified for further expansion of the industry.
- Rural youth should be motivated and made aware of the government support and policies to promote ecotourism in the state this will help to generate employment, motivate

entrepreneurs and reduce migration. The Atal Bihari Vajpayee Institute of Mountaineering and Allied Sports, (ABVIMAS) Manali, can play a major role in training local youths from different rural areas that can gain employment as guides, sports/adventure activities incharge and trainers at ecotourism sites. This will ensure local community involvement and socio-economic development which is one of the major objectives of ecotourism and will also increase the activities for tourist's facilitation while ensuring safety of the visitors. Agrawal (2016) stated that the presence of huge skilled and unskilled labor provides India with a unique opportunity for seeking inflow of the tourists.

- Himachal Pradesh has strong cultural, traditional, religious and historical background. This strength can be combined with the ecotourism activities by identifying sites near to the attractions and organizing treks and tours for the visitors. Local handicraft, cuisine, folksongs/music can be encouraged and involved in the tourists facilitation activities and local economic earning activities can be promoted. This will diversify and strengthen the industry and in addition will help in sustenance of the varied richness of the state.
- Tourism's contribution in state's GDP is quite significant this can be used as an opportunity to divert the funds and the political attention from mass tourism activity to ecotourism. During the process the share of tourism sector in state's GDP will continue and also economic returns from ecotourism sector will increase.
- Scientifically planned ecotourism can be allowed in the buffer area of the state's vast network of protected areas (5 national parks, 26 wildlife sanctuaries and 3 conservation reserves), this will not only promote the ecotourism but also awareness can be created amongst the tourists regarding wildlife conservation and forest ecosystem management in Himalayan region. Strict planning has to be considered regarding the natural resource management and biodiversity conservation through regular sustainability assessment for such establishments. Furthermore, carrying capacity assessment should be strictly considered to decide the flow of tourists to such sites.
- Ecotourism sites can be used as amean to promote and raise awareness amongst the tourists, locals and general masses regarding the judicious utilization of natural resources, environment conservation and management. This in turn will also help in the promotion of ecotourism industry. Use of various means including brochures and other publications,

involving visitors and locals in conservation activities like plantation, etc, can be done for the purpose. This initiative is already being taken up at certain sites like Aamod (Dalhousie) the where plants can be adopted by the visitors and they can take periodic follow up of their plant's growth from home. Also the site managers have published literature about the biodiversity and history of Himachal which enlighten and create awareness amongst the visitors.

ST Strategies

Following strategies have been identified by virtue of which the strengths of ecotourism can be utilized to reduce the vulnerability of the industry to the external threats:

- To avoid negative impacts of ecotourism related activities on sensitive biodiversity and ecosystems a particular plan has to be developed in order to conserve the ecology in accordance with national and international programmes for conservation like IUCN (2012) red list of protected species. The state has a strong and strict policy and law framework for the conservation of biodiversity, other natural resources and environment; these should be integrated with the priority species and areas along withpublic participation.
- The scientific community, ecotourism industry, government authorities, tourists visiting the natural areas and the local population involvedin ecotourism must continually be educated and informed about ways to promote successful ecotourism policies and practices. Social equity and environmental responsibility must be pushed on priority basis in the policy agenda to maximize and promote sustainable ecotourism potential in the state. Rangaswamy, 2012 has also ascertained healthy relationship and legal protection of rights and responsibility enforcement amongst stakeholders for sustainable ecotourism development.

WO Strategies

The strategies which can be used to overcome weaknesses by harnessing available opportunities for ecotourism development in the area are put forth as follows:

- Tourism industry is a multi-disciplinary industry and multiple sectors are involved in it which incorporate a range of stakeholders, including government, private sector, NGOs, local communities, religious leaders, and tourists, so, in order to make ecotourism a success, multi-sectoral approach through the co-ordination between institutions in its planning, implementation and monitoring should be adopted. The lack of awareness on environment management, conservation, judicious utilization of natural resources amongst the tourists, local community members, general public and other stakeholders can be avoided by means of awareness camps, workshops and meetings periodically. Mass media, social media, educational institutes and use of other possible platforms can be utilized to overcome this weakness.
- There is dearth of data and other information required for sustainable development of ecotourism and effective implementation of the policy, so there is a need to increase research funding for scientific studies and research in the area to decrease any sort of negative impacts.
- Poor publicity and marketing needs to be tackled by utilizing latest technology to attract more tourists towards ecotourism sites. The use of online marketing modes like creating attractive and informative websites and use of social media platforms for publicity can be used for the purpose. Awareness amongst the tour and travel agents for better marketing and promotion of ecotourism sites by collaborations and organizing workshops, campaigns and meetings should be done.
- Pota cabins and other nature friendly structures like bamboo huts and industrial wood can be established at high altitude sites to avoid losses during heavy snow.Improving road network and accessibility to the sites established in the mountainous areas should also be considered.
- Untrained staff at sites is a major weakness observed during the survey, this can be overcome by training the staff at The Institute of Hotel Management (IHM) atKufri, Shimla and other related institutes. A special course related to training of youth for ecotourism sites can be incorporated in the curriculum.
- Unplanned waste disposal at certain sites can lead to environment deterioration in the adjacent surroundings. Integration of scientific waste management plan into

environmental education and planning, adoption of solid waste management rules and regulations by the site managers and visitors should be promoted to avoid degradation of the surrounding flora and fauna.

- Host communities should necessarily be made to participate in the planning and provision of ecotourism in any area. Local community may be motivated to increase their involvement in sustainable tourism activities as well as to improve livelihood options through ecotourism activities, especially the participation of women self help groups, youth clubs and other community groups in the ecotourism activities will help in ecotourism development.Another opportunity from community involvement point of view is through the development of proper ecotourism package involving local people in decision making and planning so that there is a larger involvement of the local people that will ensure sustainable operation and development of the activity. Oladi (2006) also recommends that the best method to prevent forest destruction is to employ local people for forest preservation purposes. Increasing the awareness amongst thepopulation around the ecotourism sites towards this idea or nature tourism is very important to bring sustainable development and nature conservation.

The suggestions are in line with the conclusions of Komppula (2014) who has also emphasized upon the important role played by small groups in ecotourism competitiveness in rural areas of Finland, demonstrating the important of collaboration to enhance the destination image.Gilmour(1995) also recognized that for the concept of sustainable development there is a need to link conservation of resources with the development needs of rural population who depend on the resources.Woodolleck and Yaffee (2000) have also stated that for ensuring rural tourism partnershipsuccess for ecotourism activity in any area should be done by paying particular attention to two important spheres i.e. ensuring their partnership is meaningful, effective and enduring; and second by fostering a sense of responsibility amongst them.

WT Strategies

To establish a defensive plan to prevent the weaknesses from making the ecotourism venture highly susceptible to the external threats following strategies have been suggested:

- Ecotourism infrastructure development should be harmonized with population increase and crowd caused by tourist visits. As the state is also categorized under seismic zone IV and V the site and infrastructure established should be done accordingly. Earthquake resistant construction should be adopted and the relevant material should be used for the purpose.
- To improve the quality of infrastructure, such as road transport systems, hospitality and accommodation centers, medical and health services, increasing access to new technologies, such as internet, telephone-posts, guiding software and other related technologies in ecotourism regions, more invested should be directed towards the purpose. Improvement of telecommunication system, information technology system and the banking services is also needed**.**
- To avoid threats related to environmental degradation, developing international collaborative activities to receive support in the field of research and development related to sustainable ecotourism should be considered by the stakeholders.
- Additional research is needed to refine the suitability of any area for ecotourism purpose; the ecological sensitivity and risky areas should be identified and considered as one factor in site suitability to avoid any natural calamity related threats.
- A strict check on illegal cutting of trees, cattle grazing and other activities responsible for deteriorating the forests environment should be practiced by the forest and environmental conservation authority to conserve the scenic beauty of the area around the sites to sustain regular tourist flow.
- In order to compete against the mass tourism sector and other emerging ecotourism ventures in the neighboring states, the ecotourism industry in Himachal Pradesh has to incorporate innovations and new ideas. Attracting tourists throughout the year by holding ecotourism festivals in the areas during different weather, showcasing climatic variability, culture and products. The government should promote the natural resource based products of the native area through mass media communication and other means of interpretation.
- For conserving natural ecosystems and making effort to decrease negative impacts, the feasibility of implementing ecotourism plans considering environmental requirements

with emphasis on conserving native culture and prevention of the traditional context alteration should be considered by the authorities.

The results concluded from SWOT analysis showed that ecotourism in Himachal Pradesh has far more strengths and opportunities over weakness and threats, and is basically in a state of healthy progress, but with the help of the suggested strategies the industry can be further strengthened and improved for sustainable development. Ecotourism can prove to be a significant contributor in local employment and income generation and thus in social, ecological, economical and cultural development of the area of establishment. Suggested strategies should strictly adhere to the Ecotourism Policy of the state as well as consider the State Forest Policy and the New Sustainable Tourism Development Policy 2013. The findings are also in line eith the findings of Sayyed*et al.*(2013) who have also given similar strategies based on SWOT analysis for the Tandooreh National Park in Iran for sustainable ecotourism development in the region.Mondal(2017) have also concluded that strict implementation of environmental regulations related to ecotourism is important for sustenance of ecotourism. Gultekin(2010), has also stated that in ecotourism plans, diversifying economic and ecologic activities by starting and developing organized practices, enhancing the life quality of the locals with the economic gains provided by ecotourism, increasing the local participation, habitat conservation, improving environmental conscious, conserving natural, cultural and historical landscape values and passing them onto the next generation and popularizing ecotourism concept and planning with the support and participation of responsible and related organizations should be aimed for sustainable ecotourism development.

Chapter-5

SUMMARY AND CONCLUSION

The investigation entitled **"Sustainability Assessment and Identification of Ecotourism Sites in Himachal Pradesh"** was conducted during the years 2018-2020. Himachal Pradesh with rich natural heritage has become one of the leading tourist destinations in the country both for national and international visitors which is presently double the state's population. The state has strengthened its ecotourism activities to enable tourists to experience the natural heritage by bringing wilderness and virgin ecosystems of the state closer to the visitors and at the same time to increase the livelihood opportunities for mountain people and to ensure the conservation of natural environment on sustainable basis. Therefore, the present study was conducted to assess the sustainability of ecotourism activities being undertaken by the State Forest Department and through People Public Partnership (PPP) mode.

Under both the categories 16 ecotourism sites in different parts of the state were selected and sustainability was assessed by considering UNWTO sustainability indicators on a comparative basis by considering indicators like energy consumption/demand, water demand, waste management, community involvement, local employment and tourist facilitation; carrying capacity and water quality parameters. Ranking of the sites was done on the basis of the impact of ongoing activities categorized under the above mentioned indicators considering the data collected during field survey and through interviews. In order to expand ecotourism industry in the state new potential ecotourism areas were also identified by randomly selecting five blocks, through AHP using remote sensing and GIS techniques. Finally, to develop strategies for the sustainable growth and expansion of the ecotourism industry in Himachal Pradesh SWOT technique was used. The results obtained are summarized under different headings in this chapter.

Sustainability of ecotourism activities in the state

Amongst the PPP sites Aamod, Shoghi with a mean rank of 53.33 was found to be the least sustainable, followed by Nature Camp, Narkanda (40.56) > Park woods, Aanji (28.89) > Aamod, Dalhousie (36.17) > Nature Camp, Sanawar (34.39) > Nature's Treat Khalogra, (33.89) > Himalayan Nature Camp, Jalodi (28.78). While Pine Hills Eco-Camp, Chewa with

a mean rank of 26.83 was found to be the most sustainable PPP site. However, amongst the Departmental sites, Ecotourism Site, Paneo was found to be least sustainable with a mean rank of 50.28 followed by Ecotourism Site, Sahoo (42.11) > Nature Park, Jhiri (38.17) > Ecotourism Site, Holi (36.83) > Children's Park, Hamirpur (34.44) > Ecotourism Site, Devidarh (33.11) > Ecotourism Site, Kasol (30.39). Ecotourism Site, Prashar was found to be the most sustainable with a mean rank of 26.67.

Overall, PPP sites with a mean rank of 8.11 were found to be more sustainable than the Department ecotourism sites with a mean rank of 10.89. While analyzing the impact of ecotourism activities on the selected indicators by the PPP activities, potable water demand with a total indicator score of 28 was found to be highly impacted and local employment indicator (15) was found to be least impacted. PPP activities were found to impact the energy consumption, waste management and cost to users indicators equally with a total rank score of 24 while the others were impacted in the order of community involvement (23) > tourists facilitation (20) > bio-capacity (18) > building material (16). Correspondingly, energy consumption and waste management indicator were found to be highly impacted by Departmental activities with a total indicator score of 30 each, while other indicators were impacted in the order of community involvement (26) > building material (25) = tourist facilitation (25) > local employment (22) > potable water demand (20) > cost to users (18) > bio-capacity (17.

Carrying Capacity

Carrying capacity calculation was done to determine the sustainability with regard to the number of tourist inflow on the sites. The Departmental sites have higher ECC (1150 visitors^{-day}) than the PPP sites with an average ECC of 368 visitors^{-day}. The ECC amongst the PPP sites ranged from 143 visitors^{-day} to 1079 visitors^{-day} and was in the order of Nature Camp, Narkanda (1079 visitors^{-day}) > Himalayan Nature Camp, Jalodi (525 visitors^{-day}) > Aamod, Dalhousie (373 visitors^{-day}) > Nature's Treat, Khalogra (220 visitors^{-day}) > Nature Camp, Sanawar (211 visitors^{-day}) > Pine Hill Eco-camp, Chewa (209 visitors^{-day}) > Aamod, Shoghi (179 visitors^{-day}) > Park Woods, Aanji (143 visitors^{-day}).

For Departmental sites the ECC ranged from 120 visitors^{-day} to 3635 visitors^{-day} and was found in the order of Ecotourism Site, Prashar (3635 visitors^{-day}) > Children's Park, Hamirpur (2025 visitors^{-day}) > Ecotourism Site, Holi (972 visitors^{-day}) > Ecotourism Site,

Devidarh (975 visitors^{-day}) > Ecotourism Site, Paneo (888 visitors^{-day}) > Nature Park, Jhiri (369 visitors^{-day}) > Ecotourism Site, Sahoo (213 visitors^{-day}) > Ecotourism Site, Kasol (120 visitors^{-day}).

For PPP sites, the calculated ECC was beyond the actual number of visitors, but at Aamod, Shoghi the difference between ECC and actual number of visits i.e. 59 visitors^{-day} is minimum amongst all the sites while the maximum difference of 1037 visitors^{-day} was found for Nature Camp, Narkanda. For Departmental sites as well, the calculated ECC was more than the actual number of tourists that visits the sites per day. Ecotourism site, Kasol has the least (105 visitors^{-day}) and Ecotourism Site, Prashar has the highest (3438 visitors^{-day}) difference between ECC and actual number of visits per day.

Ecotourism Sustainability Projection

With the current rate of tourist inflow in the state, the sustainability status of the ecotourism sites in terms of carrying capacity may start to deteriorate in the next 26-27 years. On an average, the PPP ecotourism sites in Himachal Pradesh can surpass their carrying capacity limits in the next 19 years, while Departmental sites may start to lose the sustainability in terms of carrying capacity within next 34 years if, management strategies being currently followed are not improved. Measures have to be taken before the tourists start to exert pressure on the natural resources of the area as depicted by the exhausting carrying capacity. There is a large difference between RCC and ECC for most of the sites; therefore, the sites can enhance their capacity by increasing management capacity with the help of measures like incorporating better infrastructure and equipment; employing more trained staff and improving the accommodation facilities.

Water Quality

The water pH ranged from 7.07 to 7.72 for PPP sites, and from 7.10 to 7.61 for Departmental sites. EC ranged from 0.24 dSm^{-1} to 0.56 dSm^{-1} for PPP sites while for Departmental sites it ranged from 0.29 dSm^{-1} to 0.66 dSm^{-1}. TDS of the water sources at the PPP sites ranged from 233.12 mgl^{-1} to 298.76 mgl^{-1} while it ranged from 238.46 mgl^{-1} to 292.12 mgl^{-1} for Departmental sites. At PPP sites BOD ranged from 0.81 mgl^{-1} to 2.56 mgl^{-1} and 1.06 mgl^{-1} to 2.62 mgl^{-1} for Departmental sites. All the water quality parameters were found within the permissible limits.

Potential Ecotourism Sites

Amongst the five randomly selected blocks for identifying more potential areas for ecotourism, Sangrah block was found to have maximum area (11.16%) under highly suitable class that accounts for around 53.41 km^2 of the block area, followed by Kalpa (8.6%), Seraj (7.56%) and Bharmaur (6.19%) having 155.22 km^2, 35.79 km^2 and 102.45 km^2 area respectively. The block with the least percentage of area under highly suitable class is Chirgaun block with 3.05% (30.18 km^2) area in this category. For moderately suitable class, the blocks followed the order, Sangrah > Seraj > Kalpa > Chirgaun > Bharmaur, with percentage area of 57.55% (275.47 km^2), 52.90% (250.45 km^2), 42.8 % (775.54 km^2), 42.02% (415.93 km^2) and 29.32% (485.27 km^2) respectively. The blocks in decreasing order of area under marginally suitable class are Bharmaur > Kalpa > Chirgaun > Seraj > Sangarh with 55.44% (917.48 km^2), 47.6% (863.62 km^2), 44.42% (439.63 km^2), 36.81% (174.25 km^2) and 27.13% (129.85 km^2) respectively. The blocks with area not at all suitable for ecotourism purpose followed the order Chirgaun (10.51%) > Bharmaur (9.05%) > Sangrah (4.16%) > Seraj (2.73%) > Kalpa (1.0%) with 104.04 km^2, 149.76 km^2, 19.92 km^2, 12.91 km^2 and 18.75 km^2 area respectively.

Strategies for sustainable ecotourism development based on SWOT technique

Tourism is the main pivot for Himachal Pradesh and to develop the ecotourism industry in a sustainable manner it is crucial to plan according to some strategy. So, a SWOT analysis was performed for developing a strategic plan considering the Strength, Weaknesses, Opportunities and Threats of the ecotourism industry and features of the state. The major strengths found are the variety of natural attractions, unique ecosystems, high biodiversity, unique terrain and topography, well established tourism market; State's Ecotourism Policy, clean, green and safe environment, a vast network of protected areas, and tourism acceptance at community level. However, insufficient ecotourism based infrastructure, lack of awareness on environment management and conservation, absence of planned promotion and marketing, lack of coordination among the stakeholders, dearth of awareness amongst the tourists, unavailability of trained staff, absence of regular monitoring and inspection, lack of scientific resource management and inefficient waste management practices were recorded as the major weaknesses of the ecotourism industry in Himachal Pradesh. Many opportunities were also identified during the analysis that can be harnessed for sustainable development of ecotourism including, increasing popularity of low impact tourism amongst the tourists, new

areas can be developed as ecotourism sites, various policies and initiatives of the state government to encourage ecotourism, national and international firms are interested to invest in nature based tourism, continuously increasing tourist inflow, availability of online marketing and publicity modes and presence of training institutes for training staff for the industry. On the contrary, there are some threats identified during the study faced by the ecotourism industry viz. potential negative cultural and environmental impacts due to some activities, competition from main stream tourism industry and emerging competitors, climatic and weather threats including landslides, earthquake, cloud bursts, heavy snow, hailstorm, avalanche, etc.

Considering SWOT analysis, following strategies are suggested for planned ecotourism establishment and development in the state: adoption of environment friendly renewable energy sources, improve the quality of infrastructures and adoption of scientific waste management practices. For attracting more tourists planned promotion and marketing of the sites should be done, in addition to establishing and developing new potential ecotourism sites to accommodate more tourists. Rural youth should be motivated, made aware and trained to take up ecotourism activity as an entrepreneurial approach. Local community has to be motivated by different means to increase their involvement in ecotourism activities and integration of traditional socio-cultural activities and art with ecotourism activities can prove to a boon for the industry. Existing ecotourism sites should be used to promote and raise awareness amongst the tourists, locals and general public for environment conservation, judicious utilization of natural resources and training of local youth for operating the sites. In order to make ecotourism a success a multi-sectoral approach through co-ordination between various stakeholders in planning, implementation and monitoring should be adopted. Increase in research funding for scientific studies and research in the ecotourism area to decrease any negative impacts can help sustain environment. Strict implementation of State Ecotourism Policy for ecological sustainability has to be ensured along with diversion of funds and political attention from mass tourism activity to ecotourism.

Conclusion

The study inferred that the ecotourism sites adopting renewable energy sources, scientific waste management, judicious resource utilization, local community participation and are providing variety of services to the tourists on nominal prices are proved to be more

sustainable indicating that these state of affairs needs to be established and enhanced. PPP sites were found to be more sustainable than the Departmental sites as per the assessment done with the help of sustainability indicators. Ecotourism activities presently operating in the state are functioning well within their carrying capacity limits, however, it is also concluded that Departmental sites have a much wider scope of improvement and accommodating more tourists than the PPP sites in terms of ECC. Because of increasing tourist inflow, most of the sites may exhaust their carrying capacities within next 26-27 years because of limitations of water availability, increasing visitor frequency, and non adoption of green initiatives like solar energy, nature friendly infrastructure and scientific waste management this may pose a threat to the sustainability of this activity. In order to enhance the sustainability of ecotourism sites, the stakeholders should manage their activity by focusing on indicators like water, energy, waste management, tourist's facilitation and community involvement. In the state there is a paramount need of enhancing community involvement in ecotourism activities especially in the decision making process for maintaining sustainability. The highly and moderately suitable areas available in the state, identified on the basis of selected criterion can be explored and ecotourism site can be established with planned strategy for transforming mass tourism to ecotourism. This will also ensure long term livelihood for the rural mountain communities to support socio-economic growth in the area along with natural resource conservation. Furthermore, a cohesive sustainability plan should be developed for the development of ecotourism activity in the state taking in account the significant changes in prevailing environmental, social-cultural, and economic conditions. By acknowledging the strengths possessed by ecotourism endeavor in the state; harnessing opportunities available for the venture and by overcoming weaknesses and avoiding threats by employing and implementing the recommended strategies, the ecotourism industry can be strengthened.

LITERATURE CITED

Agrawal V. 2016. A review of Indian tourism industry with SWOT analysis. *Journal of Tourism and Hospitality* 5(1):196.

Aklibasinda M and Bulut Y. 2014. Analysis of terrains suitable for tourism and recreation by using geographic information system (GIS). *Environmental Monitoring and Assessment* 186(9): 711–719.

Ali Baba, Seyed Masoud Monavari , Borhan Riazi , Nematollah Khorasani , Mir Masoud Kheirkhah Zarkesh , 2015. A spatial decision support system for ecotourism development in caspian hyrcanian mixed forests ecotourism region, Department of the Environmental Science Faculty of the Environment and Energy.

Ambecha AB, Melka GA and Gemeda DO. 2020. Ecotourism site suitability evaluation using geospatial technologies: a case of Andiracha district, Ethiopia. *Spatial Information Research* 28: 559–568. https://doi.org/10.1007/s41324-020-00316-y

Ananda J and Herath G. 2002. Assessment of wilderness quality using the Analytic Hierarchy Process. Tourism Economics 8: 189-206.

Anonymous. 2020. Ecotourism and the scope in India. https://inc42.com/resources/ecotourism-and-the-scope-in-india/ [Accessed on: 20-02-2021]

Anup KC, and Thapa Parajuli, RB. 2014b. Tourism and Its Impact on Livelihood in Manaslu Conservation Area, Nepal. *Environment Development and Sustainability* 16: 1053–1063.

Anup KC, Rijal K and Sapkota RP. 2015. Role of ecotourism in environmental conservation and socioeconomic development in Annapurna conservation area, Nepal. *International Journal of Sustainable Development and World Ecology 22*(3): 251-258.

Ap John and Crompton JL. 1998. Developing and testing a tourism impact scale. *Journal of Travel Research* 37(2): 120–130.

APHA. 2012. *Standard Methods for Examination of Water and Wastewater*. American Public Health Association. Washington DC 1496p.

Arabinda L. 2003. *Integrating GIS and Multicriteria Decision Making Techniques for Land Resource Planning*. M.S. thesis. International Institute for Geo-Information Science and Earth Observation. Enschede: The Netherlands 80p.

Armono HD, Rosyid DM and Nuzula NI. 2017.Carrying capacity model applied to coastal ecotourism of Baluan National Park, Indonesia. *Earth and Environmental Science* 79(1):1-8.

Ashok S, Tewari HR, Behera MD and Majumdar A. 2017. Development of ecotourism sustainability assessment framework employing Delphi, C&I and participatory methods: a case study of KBR, West Sikkim, India. *Tourism Management Perspectives* 21: 24-41.

Asmamaw D and Gidey E. 2018. Identification of potential eco-tourism site suitability using AHP and GIS, a case of Hugumburda forest and its surrounding areas, Ethiopia. *Advance in Environmental Waste Management and Recycling*1(1):1-4.

Aylward B, Allen K, Echeverría J and Tosi J. 1996. Sustainable ecotourism in Costa Rica: the Monteverde cloud forest preserve. *Biodiversity and Conservation* 5:315-343.

Azizur RM. 2010. *Application of GIS in Ecotourism Development: ACase Study in Sundarbans, Bangladesh*. Mater thesis. Department of Social Science. Mid-Sweden University. Sweden.79p.

Bahmanpour H, Moharamnejad N and Laghai HA. 2012. Investigating and Identifying Environmental Potential and Natural Attraction for Ecotourism Planning, Case Study: Abr Mountain Forest, Shahrood – Iran. *European Journal of Experimental Biology* 2 (4):919-926.

Baniya N. 2008. *Land Suitability Evaluation Using GIS for Vegetable Crops in Kathmandu Valley, Nepal*. Ph.D. Dissertation. Faculty of Agriculture and Horticulture. Humboldt University zu Berlin 259p.

Barna C, Epure M and Vasilescu R. 2011. Ecotourism - conservation of the natural and cultural heritage. *Review of Applied Socio-Economic Research* 1:87-95.

Bhaduria SBS. 2016. Development and promotion of eco-tourism in Sikkim. In: *Sikkim Forestry 100 Years of Service*. Department of Forest, Government of Sikkim, Gangtok 120-160pp.

Bhandari BS, Mehta JP and Tiwari SC. 2000. Dominance and diversity relations of woody vegetation structure along an altitudinal gradient in a montane forest of Garhwal Himalaya. *Journal of Tropical Forest Science*12:49-61.

Bharadwaj SK, Aditya, Sharma A and Rakesh. 2019. Impact assessment of ecotourism activities in mid hills of Himachal Pradesh, India. *Journal of Pharmacognosy and Phytochemistry* 1: 317-321.

Bhattacharya AK and Banerjee S. 2003. Relevance of carrying capacity and eco-development linkages for sustainable ecotourism. *The Indian Forester* 129(3): 330-340.

Bhattacharya D, Chowdhury B and Sarkar R. 2011. *Irresponsible Ecotourism Practices Flanking the Best National Park in India: A Multivariate Analysis*. 2nd International Conference on Business and Economic Research (2nd October 2011) Proceeding 1901- 1928.

Bhaya S and Chakraabarty A. 2016. A GIS based ecotourism potential site selection for promotion of tourism in Jungle Mahalof West Bengal. *International Journal of Current Research* 8(11): 41043-41055.

Bjork P and Higham J. 2007. *Critical Issues in Ecotourism: Understanding a Complex Tourism Phenomenon.* Elsevier, Butterworth Heineman 439p.

Bonilla JML and Bonilla LML. 2009. Tourist cargo capacity: revision criticism of a sustainability measurement instrument. *The Sustainable Periplus* 15:123-150.

Boo E. 1993. Ecotourism Planning for Protected Areas. *In: Ecotourism:A Guide for Planners and Managers* (Lindberg K and Hawking DE). Ecotourism Society, USA 15-31pp.

Buckley R. 1999. An ecological perspective on carrying capacity. *Annals of Tourism Research* 26:705-708.

Buckley R. 2008. *Environmental Impacts of Ecotourism*. CABI Publishing, British Library, London, UK 389p.

Bunruamkaew K and Murayama Y. 2011. Site suitability evaluation for ecotourism using GIS & AHP: a case study of Surat Thani Province, Thailand. *Journal of Procedia Social and Behavioural Sciences* 21:269-278.

Butler RW. 1992. *Ecotourism: It's Changing Face and Evolving Philosophy*. 4th World Congress on National Parks and Protected Areas, Caracas, Venezuela 6p.

Campbell D. 1994. Ecotourism booms in south east Asia. *The Ecotourism Society Newsletter* 4:1-3.

Casanova LM, Gerba CP and Karpiscak M. 2001. Chemical and microbial characterization of household greywater. *Journal of Environmental Science and Health* 34: 395-401.

Center for Responsible Travel. 2016. *The Case for Responsible Travel: Trends & Statistics 2016.* CREST 15p.

Central Pollution Control Board (CPCB). 2017. Water Quality Criteria. www.cpcb.nic.in/water-quality-criteria [Accessed 20 Jun. 2018]

Chandra A. 2017. 10 states that are promoting ecotourism in India & encouraging responsible travel. https://traveltriangle.com/blog/ecotourism-in-india/ [Accessed 10 April 2019].

Chang NB, Parvathinathan G and Breeden JB. 2008. Combining GIS with fuzzy multi-criteria decision-making for landfill sitting in a fast growing urban region. *Journal of Environmental Management* 87: 139-153.

Chhetri P and Arrowsmith C. 2008. GIS-based Modelling of Recreational Potential of Nature-Based Tourist Destinations. *Tourism Geographies* 10(2):233-257.

Chudintra S. 1993. Nature Tourism Profile: Thailand. *In:Nature Tourism in Asia: Opportunities and Constraints for Conservation and Economic Development* (Nenon J and Durst PB). Forestry Support Programme, Washington DC 31-41pp.

Cifuentes M. 1992. *Determination of Tourism Load Capacity in Protected Areas*. Agronomic Center Tropical Research and Teaching, Turrialba, Costa Rica 28p.

Coccossis H and Mexa A. 2004. *The Challenge of Tourism Carrying Capacity Assessment: Theory and Practice.* Aldershot, Ashgate 312p.

Das M and Chatterjee B. 2015. Ecotourism and empowerment: a case analysis of Bhitarkanika Wildlife Sanctuary, Odisha, India. *IIMKozhikode Society & Management Review* 4:136-145.

Degang W and Xiaoting H. 2006. Coincidence and Upgrade: A Typical Case Study of Rural Ecotourism Development. *Chinese Journal of Population Resources and Environment: 4*(1): 45-53.

Delamaro M and Bursztyn I. 2008. Tourism for whom: different paths to development and alternative experiments in Brazil. *Latin American Perspective* 35:103-119.

Dev S. 2005. A Study on the Quality of Service at Thenmala Ecotourism Destination. *The Green Portal Tourism Journal* 2(2): 21-22

Diamintis D. 2004. *Ecotourism: Management and Assessment*. London Thomson 256p.

Duffy R. 2002. *A Trip Too Far:Ecotourism, Politics and Exploitation*. Earthscan Publications, London 210p.

Duffy R. 2008. Neo-liberalizing Nature: Global Networks and Ecotourism Development in Adagasgar. *Journal of Sustainable Tourism 16*(3): 327-344.

Eagles P, McCool S and Haynes C. 2002. *Sustainable Tourism in Protected Areas*. International Union for Conservation of Nature, Gland, Switzerland 191p.

Economic survey of Himachal Pradesh. 2020-2021. *Saving Lives and Livelihoods*. Economics and Statistics Department. Himachal Pradesh 187p.

Eddie WL, Li H and Yu L. 2007. A GIS approach to shopping mall location selection. *Building and Environment* 42: 884-892.

Ehmer P and Heymann E. 2008. *Klimawandel und Tourismus: Wohingeht die Reise*? Frankfurt: Deutsche Bank Research 31p.

Fadahunsi JT. 2011. Application of geographical information system (GIS) technology to tourism management in Ile-Ife, Osun State, Nigeria. *The Pacific Journal of Science and Technology* 12(2): 274-283.

Farrell BH and Runyan D. 1991. Ecology and Tourism. *Annals of Tourism Research* 18: 26-40.

Farrell T and Marion J. 2001. Identifying and assessing ecotourism visitor impacts at eight protected areas in Costa Rica and Belize. *Environmental Conservation* 28:215-225.

Fennel D and Dowling R. 2003. The context of ecotourism policy and planning.In:*Ecotourism policy and planning*1-20pp.

Fink A. 2003a. *How to ask survey questions*. 2nd edition. Sage Publications Inc., California 115p.

Fink A. 2003b. *The survey handbook*. 2nd edition. Sage Publications Inc., California 184p.

Fletcher R. 2015. Nature is a nice place to save but I wouldn't want to live there: environmental education and the ecotourist gaze. *EnvironmentalEducation Research* 21:338-350.

Funnel DC and Bynoe PE. 2007. Ecotourism and institutional structures: the case of North Rupununi, Guyana. *Journal of Ecotourism* 6(3): 163-183.

Genzong X, Penghua Q and Shaoxia T. 2007. Nature Reserve and Ecotourism Development in China's Wuzhishan Mountain Region. *Chinese Journal of Population Resources and Environment 5*(1): 74-83.

Geremew YM and Hailemeriam LY. 2015. Site Suitability Evaluation of Ecotourism Potentials for Sustainable Natural Resource Management and Community Based Ecotourism Development: The Case of Bench Maji Zone, South. *Journal of Arts, Humanities and Social Sciences* 3(8B): 1368-1383.

Gilmour DA. 1995. Conservation and development: seeking the linkages. Community development and conservation of forest biodiversity through community forestry. Proceedings of an International Seminar, Bangkok, Thailand. October 26-28, 1995.

Global Report on Women in Tourism 2010. 2011. *United Nations Entity for Gender Equality and the Empowerment of Women*, New York. 12p.

Gomez KA and Gomez AA. 1984. *Statistical Procedures for Agricultural Research* (2 ed.). John Wiley and sons, NewYork 680p.

Gray N. 2003. Unpacking the baggage of ecotourism: nature, science and local participation. *Great Lakes Geographer* 9:113-123.

Green H. 1995. Environmental impact of tourism. In *Tourism and environment: a sustainable relationship?*C. Hunter & H. Green (Eds.). London: Routledge Publication10–51pp.

Gurung DB and Scholz RW. 2008. Community-based Ecotourism in Bhutan: Expert Evaluation of Stakeholder-based Scenarios. *International Journal of Sustainable Development and World Ecology 15*(5): 397-411.

Harrison JP. 2010. *Essentials of Strategic Planning in Healthcare*. Chicago: Health Administration Press 214p.

Hawkins DE. 2004. A Protected Areas Ecotourism Competitive Cluster Approach to Catalyse Biodiversity Conservation and Economic Growth in Bulgaria. *Journal of Sustainable Tourism 12*(3): 219-244.

Higgins-Desbiolles F. 2006. More than an "Industry": the forgotten power of tourism as a social force. *Tourism Management* 27(6): 1192–1208.

Holden A. 2003. *Environment and Tourism*. 1st ed. Rutledge, England 62p.

Honey M. 2008. *Ecotourism and Sustainable Development: Who Owns Paradise?* 2nd ed. Island Press, Washington DC 568p.

Hunt CA, Durham WH, Driscoll L and Honey M. 2015. Can ecotourism deliver real economic, social, and environmental benefits? A study of the Osa Peninsula, Costa Rica. *Journal of Sustainable Tourism* 23(3):339-357.

Jacobson S and Robles R. 1992. Ecotourism, sustainable development, and conservation education: development of a tour guide training program in Tortuguero, Costa Rica. *Environmental Management* 16:701-713.

Jafar O and Delavar B. 2010. Evaluating the ecotourism potentials of Naharkhoran area in Gorgan using remote sensing and geographic information. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Science* 111:1-33.

Jaini N, Robat M, Anuar ANA, Jamaluddin ER. 2019. The Identification of Criteria for Ecotourism Practice in Peninsular Malaysia. *Journal of Hotel and Business Management* 8(1): 1-6 doi: 10.35248/2169-0286.19.8.190

Jalani J. 2012. Local people's perception on the impacts and importance of ecotourism in Sabang, Palawan, Philippines. *Procedia - Social and Behavioral Sciences* 57:247-254.

Jamal T and Stronza A. 2008. Dwelling with ecotourism in the Peruvian Amazon: cultural relationships in local-global spaces. *Tourist Studies* 8:313-335.

Kiper T, Ozdemir G and Saglam C. 2011. Environmental, socio-cultural and economical effects of ecotourism perceived by the local people in The Northwestern Turkey: Kiyikoy Case. *Scientific Research and Essays* 6(19):4009-4020.

Kiper T. 2013. Role of ecotourism in sustainable development. In: *Advances in landscape architecture*.Ozyavuz M (ed.). London: IntechOpen Limited773–802pp.

Kumari S, Behera MD and Tewari HR. 2010. Identification of potential ecotourism sites in West District, Sikkim using geospatial tools. *Tropical Ecology* 51(1), 75–85.

Kushwaha SPS, Khan A, Bilal, Habib, Quadri A and Singh A. 2004. Evaluation of sambar and muntjak habitats using geostatistical modelling. Current Science 86: 1390-1400.

Kuss FR, Graefe AR and Vaske JJ. 1990. *Visitor Impact Management.* National Parks and ConservationAssociation, Washington D.C., USA 105p.

Laarman JG and Gregersen HM. 1996. Pricing policy in nature-based tourism. *Tourism Management* 17:247-254.

Lagmoj MA, Shokry AK, Hashemi SA and Zadegan AK. 2013. Defining the Ecotourism Carrying Capacity of Langeroud City (Case Study: Khorma Forest). *Greener Journal of Social Sciences* 3(9): 447-457.

Larson and Alexander Herr. 2008. Sustainable tourism development in remote regions? Questions arising from research in the North Kimberley, Australia. *Regional Environmental Change* 8(1): 1-13.

Ledin A, Eriksson E and Henze M. 2001. Aspects of groundwater recharge using grey wastewater. In: *Decentralised Sanitation and Reuse: Concepts, Systems and Implementation.*Lens P, Zeeman G, Lettinga G (eds). IWA Publishing, London 354–370pp.

Lee S. 2011. Carrying capacity of sustainable tourism based on the balance concept between ecological damage loading and recovery capacity. *Journal of Coastal Research* 64:1297-1301.

Leung Y, Spenceley A, Hvenegaard G and Buckley R. 2015. *Tourism and Visitor Management in Protected Areas: Guidelines for Sustainability*. IUCN, Gland, Switzerland 269p.

Levy SE and Hawkins DE. 2009. Peace through tourism: Commerce based principles and practices. *Journal of Business Ethics* 89(4): 569-585.

Lindberg K and McKercher B. 1997. Ecotourism: a critical overview. *Pacific Tourism Review* 1:65-79.

Lindberg K, Furze B, Staff M and Black R. 1998. *Ecotourism in the Asia Pacific Region: Issues and Outlook.* FAO, Forest Planning and Policy Division, Rome 61p.

Lone S, Lone FA and Asif M. 2013. Carrying capacity assessment for the promotion of ecotourism in Bangus Valley; a future tourist destination of J&K- India. *Environment* 2(3):187-189.

Maldonado E and Montagnini F. 2005. Carrying capacity of La Tigra National Park, Honduras. *Journal of Sustainable Forestry* 19:29-48.

Maldonado ER. 2000. *Determination of Tourist Load Capacity, as an Option for the Sustainable Management of La Tigra National Park, Tegucigalpa, Honduras*. M.Sc Thesis. Tropical Agricultural Research and Training Center 189p.

Mandziuk G. 1995. Ecotourism: a marriage of conservation and capitalism. *Plan Canada* 35:29-33.

Manidis Roberts Consultants. 1997. *Developing a Tourism Optimisation Management Model (TOMM), A Model to Monitor and Manage Tourism on Kangaroo Island*. South Australian Tourism Commission, Adelaide, SA, Australia 34p.

Martha H. 2008. *Ecotourism and Sustainable Development: Who Owns Paradise?* Island Press, USA 405p.

Masoum MG, Nasiri G, Hosseini A and Rafil Y. 2012. Ecotourism Planning Using Remote Sensing and GIS: A Case Study for Marvdasht, Iran. **In**: Current Issues in Hospitality and Tourism: Research and Innovations CRC Press Editors: Rozita Abu, 225-229.

Masum KM, Mamun AA, Rahman ZMM and Rahman MM, 2013. Ecotourism carrying capacity and the potentiality of the safari park of Bangladesh. *Journal of Forest Science* 29(4): 292-299.

Mathieson A and Wall G. 1982. *Tourism: Economic, Physical and Social Impacts.* Prentice Hall, Toronto 208p.

Matthews EJ. 2002. *Ecotourism: Are Current Practices Delivering Desired Outcomes? A Comparative Case Study Analysis.* Major Paper submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of Master of Urban and Regional Planning in Urban Affairs and Planning106p.

Ministry of Tourism, Government of India. 2019. *Contribution of Tourism and Hospitality Sector to Economy.* Press Information Bureau, New Delhi 1p.

Mohd ZH and Ujang U. 2016. Integrating multiple criteria evaluation and GIS in ecotourism: a review.*International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* 62(1): 351-354.

Mondal SH. 2017. SWOT analysis and strategies to develop sustainable tourism in Bangladesh. *UTMS Journal of Economics* 8(2): 159–167.

Munar FXR. 2005. Management of beaches on the island of menorca (BalearicIslands): the tension between tourism and conservation. *Journal of Coastal Research* 49:89-93.

Nag A. 2013. A study of tourism industry of Himachal Pradesh with special reference to ecotourism. *Asia Pacific Journal of Marketing and Management Review* 2:89-106.

Nahuelhual L, Donoso PJ, Lara A, Nunej D, Oyarzun C and Neira E. 2007. Valuing ecosystem services of Chilean temperate rainforests. *Environment Development and Sustainability* 9(4):481-499.

National Institute of Urban Affairs. 1997. *Carrying capacity based developmental planning of National capital region*. NIUA, New Delhi 42p.

Newsome D and Hassell S. 2014. Tourism and conservation in Madagascar: the importance of Andasibe National Park *Koedoe* 56(2): 1-8.

Nghi T, Lan NT, Thai ND, Mai D and Thanh DX. 2007. Tourism carrying capacity assessment for PhongNh-Ke Bang and Dong Hoi, QuangBinh Province. *VNU Journal of Science: Earth and Environmental Sciences* 23:80-87.

Nino K, Yosef M, Mengesha G and Sahle K. 2017. GIS based ecotourism potential assessment in MunessaShashemene Concession Forest and its surrounding area, Ethiopia. *Applied Geography* 82:48-58.

Niti Aayog. 2018. *Report of Working Group II: Sustainable Tourism in the Indian Himalayan Region.*Niti Aayog. 87p.

NOAA. 2011. Assessment for sustainable tourism. http://sanctuaries.noaa.gov/ management/international/pdfs/day2_assessment_manual.pdf. [Accessed Nov 2011]

Novelli M and Gebhardt K. 2009. Community based tourism in Namibia: 'reality show' or 'window dressing'? *Current Issues in Tourism* 10:443-497.

Ntibanyurwa A. 2006. Tourism as a factor of development. *Sustainable Tourism* 2:73-84.

Nyaupane GP and Thapa B. 2004. Evaluation of ecotourism: a comparative assessment in the Annapurna conservation area project, Nepal. *Journal of Ecotourism* 3(1): 20-45.

Obadiah K, Odhiambo NM and Njuguna J. 2012. Tourism and economic growth in Kenya: an empirical investigation. *International Business & Economics Research Journal* 11(5):517-528.

Odum E. 1989. *Ecology and Our Endangered Life Support Systems*. Sinauer Associates, Stanford, CT, USA 283p.

Oppenheim AN. 1992. *Questionnaire Design, Interviewing and Attitude Measurement*. Printers Publishers. London 154p.

Ottoson J and Stenstrom TA. 2003. Faecal contamination of greywater and associated microbial risks. *Water Research* 37:645-655.

Page S and Dowling RK. 2002. *Ecotourism*. Prentice Hall, New York 338p.

Panasiuk A. 2007. Tourism infrastructure as a determinant of regional development. *Economics and Management: Current Issues andPerspectives* 1:212-215.

Panda TK, Mishra S and Parida BB. 2004. *Tourism management: The Socio-Economic and Ecological Perspective*. Universities Press. India 200p.

Patterson C. 2002. *The Business of Ecotourism: The Complete Guide for Nature and Culture-Based Tourism Operations*. Explorer's Guide Publishing Second Edition 186p.

Pegas F, Coghlan A, Stronza A and Rocha V. 2013. For love or for money? investigating the impact of an ecotourism programme on local residents' assigned values towards sea turtles. *Journal of Ecotourism* 12:90-106.

Pereira da Silva C. 2002. *Integration of Landscape Perception Studies and Digital Images in the Definition of the Load Capacity of Beaches: The Coastal Stretch Torpes and Pessegueiro Island*. PhD Thesis. New University of Lisbon, Portugal 361p.

Peroff DM, Deason GG, Seekamp E and Jennifer Iyengar. 2017. Integrating framework for evaluating tourism partnerships: An exploration of success within the life cycle of a collaborative ecotourism development effort. *Journal of outdoor Recreation and Tourism.* 17: 100-111.

Pigram JJ. 1983. *Outdoor Recreation and Resource Management*. St. Martin's Press, New York 262p.

Ponni M and Baskar R. 2015. A study on indoor temperature and comfort temperature. *International Journal of Engineering Science and Invention* 4:7-14.

Pratt L, Rivera L and Bien A. 2011. *Tourism: Investing in Energy and Resource Efficiency*. United Nations Environment Programme 632p.

Queiroz RE, Ventura AM, Guerreiro JA and Cunha da RT. 2014. Carrying capacity of hiking trails in Ntura 2000 sites: a case study from North Atlantic Islands (Azores, Portugal). *Journal of Integrated Coastal Zone Management* 14(2): 233-242.

Ramavarapu S. 2017. *Ecotourism-AYay or ANay for Conservation*? http://www.atree.org/cetv. [Accessed on 07-09-2019]

Ramchurjee NA and Suresha S 2014. Ecotourism: a case study of environmental responsible behaviour of tourists in Mysore Karnataka, India. *ZENITH International Journal of Multidisciplinary Research* 4(3): 226-242.

Rana M and Pandey V. 2016. Ecotourism development using geospatial techniques in SATTAL Camp, Surya Village, Bhimtal, Nainital, Uttarakhand. *International Journal of Arts & Education Research* 5(1): 1-9.

Rangaswamy D. 2012. Eco-tourism – A discovery tool for sustainable development. *International Journal of Social and Economic Research* 2(1): 122-131.

Rauch P. 2007. SWOT analyses and SWOT strategy formulation for forest owner co-operations in Austria. *European Journal of Forest Research* 126(3): 413-420.

Raveen R, Chennakrishnan C and Stephen A. 2008. Impact of pollution on the quality of water in three fresh water lakes of Suburban Chennai. *Nature Environment and Pollution Technology*7: 61-64.

Reimer J and Walter P. 2013. How do you know it when you see it? Community-based ecotourism in the Cardamom Mountains of southwestern Cambodia. *Tourism Management* 34:122-132.

Romadhon A, Yulianda F, Bengen D and Adrianto L. 2014. Sustainable tourism based on carrying capacity and ecological footprint at Sapeken Archipelago, Indonesia. *International Journal of Ecosystem* 4(4): 190-196.

Ross S and Wall G. 1999. Evaluating ecotourism: the case of northSulawesi, Indonesia. *Tourism Management* 20:673-682.

Rubita I. 2012. Sustainability issue in tourism: a case study of Yuksam Village, Sikkim. *Atna - Journal of Tourism Studies* 7(2):117–129.

Saarinen J. 2001. The Transformation of a Tourist Destination - Theory and Case Studies on the Production of Local Geographies in Tourism in Finnish Lapland.*Nordia Geographical Publications* 30(1): 105.

Saaty RW. 1987. The analytic hierarchy process and SWOT analysis–what it is and how it is used. *Mathematical Modeling* 9: 161-178.

Satty TL and Vargas LG. 2001. Models, methods, concepts & applications of the analytic hierarchy process. International Series in Operations Research & Management Science 34b: 1-352.

Saaty TL. 1980. *The Analytic Hierarchy Process*. McGraw-Hill, New York 331p.

Sabokkhiz M, Sabokkhiz F, Shayesteh K, Malaz J and Shieh E. 2016. Sustainable tourism management by using recreational carrying capacity concept (Case: Mesr Desert in Iran). *Review of European Studies* 8(4): 105-112.

Sadasivuni R, O'Hara CG, Nobrega R and Dumas J. 2009. A transportation corridor case study for multi-criteria decision analysis. Proceeding of the ASPRS 2009 annual conference. Baltimor, Maryland, USA 12p.

Samanta S and Baitalik A. 2015. Potential site selection for eco-tourism :acase study of four blocks in Bankura district using remote sensing and GIS technology, West Bengal. *International Journal of Advanced Research* 3(4): 978-989.

Sambotin D, Sambotin A, Patrascoiu M, Coroian A and Mercel II. 2011. Ecoturismul –Model de ValorificareDurabila a ResurselorTuristice, *LucrariŞtiinţifice, Seria.* I, Vol. XIII (4).

Sander B. 2012. The importance of education in ecotourism ventures: lessons from Rara Avis ecolodge, Costa Rica. *International Journal ofSustainable Society* 4:389-404.

Saveriades A. 2000. Establishing the social tourism carrying capacity for the tourist resorts of the east coast of the Republic of Cyprus. *Tourism Management* 21:147-156.

Sayan MS and Atik M. 2011. Recreation carrying capacity estimates for protected areas: a study of Termessos National Park. *Ekoloji* 20:66-74.

Sayyed MRG, Mansoori MS and Jaybhaye RG. 2013. SWOT analysis of Tandooreh national park (NE Iran) for sustainable ecotourism. *Proceedings of the International Academy of Ecology and Environmental Sciences* 3(4): 296-305.

Scheyvens R. 1999. Ecotourism and the empowerment of local communities. *Tourism Management* 20:245-249.

Schmoldt D, Kangas J, Mendoza G and Pesonen M. 2001. The Analytic Hierarchy Process in Natural Resource and Environmental Decision Making. Springer, The Netherlands 305p.

Science Daily. 2008. Ecotourism in Belize is Damaging Environmentally Sensitive Sites. https://www.sciencedaily.com/releases/2008/06/080613164445.htm [Accessed 20 Jun. 2018]

Scott D, McBoyle G, Mills B and Minogue A. 2006. Climate change and the sustainability of ski-based tourism in eastern North America. *Journal of Sustainable Tourism* 14(4): 376-398.

Segrado R, Munoz AP and Arroyo L. 2008. Load capacity measurement of tourist office of Cozumel. *The Sustainable Periplus* 13:33-61.

Sharma A. 2018. Master Thesis. Department of Environmental Science. Dr. YS Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh, India. 65 p.

Sharma A, Chauhan S and Bhardwaj SK. 2020. Carrying Capacity Assessment of Ecotourism Sites in Mid-Hills of Himachal Pradesh. *Climate Change and Environmental Sustainability* 8(1):38-43.

Sharma R. 2016. Evaluating total carrying capacity of tourism using impact indicators. *Global Journal of Environmental Science Management* 2:187-196.

Shelby B, Heberlein TA. 1984. A conceptual framework for carrying capacity determination. *Leisure Sciences* 6:433-451.

Simon F, Narangajavana Y and Marques DP. 2004. Carrying capacity in the tourism industry: a case study of Hengistbury Head. *Tourism Management* 25:275–283.

Sindiga I. 1999. Alternative Tourism and Sustainable Development in Kenya. *Journal of Sustainable Tourism: 7*(2): 108-127.

Singh A and Manoj PK. 2018. Ecotourism for sustainable rural development: the case of Thommankuthu ecotourism spot in Idukky district of Kerala. I*nternational Journal of Research in Management & Social Science* 6(2): 13-22

Singh T, Slotkin M and Vamosi A. 2007. Attitude towards ecotourism and environmental advocacy: profiling the dimensions of sustainability. *Journal of Vacation Marketing* 13:119-134.

Siroosi H, Heshmati G and Salmanmahiny A. 2020. Can empirically based model results be fed into mathematical models? MCE for neural network and logistic regression in tourism landscape planning. *Environment Development Sustainability* 22: 3701–3722.

Snyman S. 2014. The impact of ecotourism employment on rural household incomes and social welfare in six southern African countries. *Tourismand Hospitality Research* 14:37-52.

SoER HP. 2015. State of Environment Report, Himachal Pradesh. Department of Environment, Science and Technology, Government of Himachal Pradesh. HP State Pollution Control Board 552p.

Stankey GH, Cole DN, Lucas RC, Petersen ME and Frissell SS. 1985. *The Limits of Acceptable Change(LAC) System for Wilderness Planning*. Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT, USA 37p.

Stem CJ, Lassoie JP, Lee DR and Deshler DJ. 2003. How Eco is Ecotourism? A Comparative Case Study of Ecotourism in Costa Rica. *Journal of Sustainable Tourism 11*(4): 322-347.

Stronza A and Pegas F. 2008. Ecotourism and conservation: two cases from Brazil and Peru. *Human Dimensions of Wildlife* 13:263-279.

Suryabhagavan KV, Tamirat H and Balakrishnan M. 2015. Multi-criteria evaluation in identification of potential ecotourism sites in Hawassa town and its surroundings, Ethiopia. *Journal of Geomatics* 9(1):86-92.

Tahernejad, Mohammad M, Mohammad A and Khalokakaei K. 2013. A Strategic Analysis of Iran's Dimensional Stone Mines Using SWOT Method. *Arabian Journal for Science & Engineering* 38 (1): 149– 158.

Taylor J, Dyer G, Stewart M, Yunez A and Ardila S. 2003. The economics of ecotourism: a Galápagos Islands economy, wide perspective. *Economic Development and Cultural Change* 51:977-997.

The International Ecotourism Society (TIES). 2015. What is Ecotourism? http://www.ecotourism.org/what-is-ecotourism

Thomas KD, Williams NB and Trotz MA. 2014. The sustainability of ecotourism activities: development of an accessible, applicable, and efficient tool for assessment. *The West Indian Journal of Engineering* 36:51-62.

Tienwong K. 2008. *Applications of Geoinformatics Technology to Land Evaluation for Energy Economic Crops in Western, Thailand*. Ph.D. Dissertation. Institute of Science. Suranaree University of Technology. Nakornratchasima: Thailand 256p.

TIES. 2006. *TIES Global Ecotourism Global Factsheet.* The International Ecotourism Society, USA 6p.

Tran L and Anh DQ. 2011. *A Study on the Environmental Impact of Ecotourism in Can Gio Mangrove Biosphere, Viet Nam*. Master's thesis. Hospitality Management Department, Laurea University of Applied Sciences, Kerava, Finland60p.

Tsaur SH, Lin JH and Lin YC. 2006. Evaluating ecotourism sustainability from the integrated perspective of resource, community and tourism. *Tourism Management* 27:640-653.

UNWTO. 2004. *Indicators of Sustainable Development of Tourism Destinations: A Guidebook*. World Tourism Organisation. Madrid, Spain 516p.

UNWTO. 2018. UNWTO/GTERC Report: Asia and the Pacific grows in importance for Global Tourism. http://www2.unwto.org/press-release/2018-10-19/unwtogterc-report-asia-and-pacific-grows-importance-global-tourism. [Accessed 24 April 2019].

US Department of the Interior. 1997. *The Visitor Experience and Resource Protection (VERP) Framework: A Handbook for Planners and Managers.* National Park Service, Denver, CO, USA103p.

Usher L and Kerstetter D. 2014. Residents' perceptions of quality of life in a surf tourism destination: a case study of Las Salinas, Nicaragua. *Progress in Development Studies* 14:321-333.

Vishwanatha and Chandrashekara 2014. Evaluation of ecotourism and its types (Using SWOT analysis): a case study of Kodagu district of Karnataka, India. *Asian Research Consortium*. 4(4):191-203.

Vishwanatha S. 2015. *Ecotourism and Dimensions of its Impact – A Study on Kodagu District*. PhD thesis. Department of Studies in Geography, University of Mysore, Manasagangothri, Mysuru 188p.

Vnasiya YN and Mahida TD. 2012. The economics of ecotourism – acase study of the Dangsdistrict of Gujarat in India. *The Journal of UGC-HRDC Nainital* 6(3):455-464.

Vujko A and Plavsa J. 2014. Evaluation of Fruska Gora National Park (Serbia) for Sport and Recreational Tourism. *Acta Geographica Slovenica* 54(2): 321-334.

Wackernagel M and Rees W. 1996. *Our Ecological Footprint: Reducing Human Impact on Earth.*New Society Publishers. Gabriola Islands Canada 176p.

Wall G. 1997. Is ecotourism sustainable?*Environmental Management* 21:483-491.

Wang, Hongchen., Chang Li and Yanping Zheng. 2015. Space expression of industry status using GIS and SWOT analysis. *Wuhan University Journal of Natural Sciences* 20 (5): 445–454.

Wasike, Chrilukovian, Magothe TM, Kahi AK and Peters KJ. 2011. Factors that influence the efficiency of beef and dairy cattle recording system in Kenya: A SWOT–AHP analysis. *Tropical Animal Health and Production* 43(1): 141–152.

Watkin JR. 2003. *The Evolution of Ecotourism in East Africa: From an idea to an industry*. IIED Wildlife and Development Series 29p.

Wearing S and Larsen L. 1996. Assessing and managing the socio-cultural impacts of ecotourism: revisiting the Santa Elena rainforest project. *The Environmentalist* 16:117-133.

Wearing S and Neil J. 2009. *Ecotourism*. Butterworth-Heinemann, Oxford 286p.

Wearing S. 2001. Exploring Socio-cultural Impacts on Local Communities. *In:The Encyclopaedia of Ecotourism*. Weaver DB. CABI Publishing, New York 395-410pp.

Weaver DB and Lawton LJ. 2007. Twenty years on: The state of contemporary ecotourism research. *Tourism Management* 28: 1168–1179.

Wheat S. 1994. Is there really an alternative tourism? *Tourism in Focus* 13:2-3.

Wheelen TL and Hunger JD. 1995. *Strategic management and business policy*. UK: AddisonWesley 449p.

Wheeller B. 1991. Tourism's troubled times: responsible tourism is not the answer. *Tourism Management* 12:91-96.

Whelan C. 2013. Spotlight on sustainability: preserving cultures through ecotourism. *Good Nature Travel*. http://goodnature.nathab.com/spotlight-on-sustainability-preservingcultures throughecotourism/ [Accessed 11 Jun. 2018]

WHO. 2017. *Guidelines for Drinking Water Quality*. World Health Organisation, Geneva 631p.

Wight PA. 1996. North American eco tourists: market profile and trip characteristics. *Journal of Travel Research* 34:2-10.

Wilkinson T. 1995. Crowd control. *National Parks* 69:36-41.

Williams and Fennell. 2005. The ecotourism concept and tourism-conservation symbiosis. *Journal of Sustainable Tourism* 13(4): 373-390.

Williams P and Lemckert C. 2007. Beach carrying capacity: has it been exceeded on the Gold Coast? *Journal of Coastal Research* 50:21-24.

Wood ME. 2002. *Ecotourism: Principles, Practices and Policies for Sustainability*. United Nations Environment Programme 64p.

Woodolleck J and Yaffree SL. 2000. *Making Collaboration Work: Lessons from Innovation in Natural Resource Management.*Island Press, Washington DC 299p.

Worlds Economic Forum (WEF). 2019. The Travel & Tourism Competitiveness Report 2019 Travel and Tourism at a Tipping Point. 129p. https://reports.weforum.org/travel-and-tourism-competitiveness-report-2019/rankings/ [Accessed on 08-06-2020]

WTO. 1993. *Sustainable Tourism Development: Guide for Local Planners.* WTO-World Tourism Organization, Madrid, Spain 166p.

WTTC (The World Travel & Tourism Council). 2017. *Travel & Tourism Economic Impact 2017, India*.World Travel & Tourism Council (WTTC), London 20p.

Yilmaza O, Mansuroglub S and Yilmaz R. 2013. Environmental economics Swot analysis of ecotourısm as a tool for sustainable development: acase research in North-west Black Sea coastal zone of Turkey. *Journal of Environmental Protection and Ecology* 14(2): 786-798.

Yuksel I and Dagdeviren M. 2007. Using the analytic network process (ANP) in a SWOT analysis-A case study for a textile firm. *Information Science* 177: 3364-3382.

Yunis E. 2004. *Indicators to Measure Sustainability in Tourism*. Proceedings of the 7th International Forum on Tourism Statistics, Stockholm, Sweden 5p.

Zacarias DA, Williams AT and Newton A. 2011. Recreation carrying capacity estimations to support beach management at Praia de Faro, Portugal. *Applied Geography* 31:1075-1081.

APPENDIX-I

Tourist inflow data for Himachal Pradesh since 1997 - 2017

Year	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total	% Increase
1997	435722	295055	20372	603567	5510	732811	24832	150929	828992	258818	166907	369432	**3892947**	-
1998	459503	323905	21638	664409	6632	812895	27617	164792	912508	285103	181657	394913	**4255572**	9.31
1999	474407	336212	22863	69188 9	4181	866537	24060	174358	962691	292780	189034	405275	**4444287**	4.43
2000	465381	360713	27012	717266	4411	928050	31633	191890	1063200	317895	209608	364261	**4681320**	5.33
2001	500109	401809	33498	828198	9200	1043187	41672	240094	1167085	345520	242199	392229	**5244800**	12.04
2002	477367	358271	21840	857713	13068	1121047	48305	226794	1265570	346997	327879	128449	**5193300**	-0.98
2003	518519	405786	36265	923662	15860	1348271	58996	223254	1418035	354672	264601	144395	**5712316**	9.99
2004	584793	452269	41624	1051280	18828	1546973	69512	273060	1652628	394322	289970	174154	**6549413**	14.65
2005	634909	450090	42670	1121443	12157	1708940	67145	342227	1822059	429638	316075	188179	**7135532**	8.95
2006	682479	495519	47482	1180726	35340	1957735	83632	380855	2061824	471676	348803	207400	**7953471**	11.46
2007	728991	562335	124285	1305465	79461	2065078	125829	471952	2194685	515800	375866	271595	**8821342**	10.91
2008	683951	648262	279798	1345974	168527	2114584	214329	612240	2174456	577583	482818	446911	**9749433**	10.52
2009	886665	689489	432467	1479512	285098	2344163	316516	877974	2284295	655758	590199	595019	**11437155**	17.31
2010	962147	789416	554982	1722941	403678	2529697	421785	1016903	2613301	751311	679712	819729	**13265602**	15.99
2011	1093421	819668	630112	1912648	485046	2798015	543855	1194148	2952437	875739	807698	976619	**15089406**	13.75
2012	977636	955492	683205	2305411	460194	3226445	444075	807529	3354003	951742	874708	1105892	**16146332**	7.00
2013	1145384	994686	723182	2200623	126460	2886050	119623	883802	3156997	843643	857301	1186084	**15123835**	-6.33
2014	1241423	1091844	753193	2333367	28581	3291745	90393	945721	3349872	902338	919498	1366425	**16314400**	7.87
2015	1369157	1124091	855267	2509813	119911	3423931	91203	1096709	3415307	1019437	1079178	1427149	**17531153**	7.46
2016	1432271	1163090	906926	2652732	100727	3637233	116037	1163795	3582105	1063176	1124810	1507618	**18450520**	5.24
2017	1617371	1181777	980613	2823289	466380	3865101	118920	1242040	3480997	994874	1231559	1598612	**19601533**	6.24
2018	1437537	1043182	856111	2225126	231348	3008753	133153	1115224	2995013	966254	1149082	1289720	**16450503**	-16.08
2019	1499987	1044591	901740	2342887	249946	3159411	132983	1162206	3162854	1008600	1201211	1345691	**17212107**	4.63
Total	**20309130**	**15987552**	**8997145**	**35799941**	**3330544**	**50416652**	**3346105**	**14958496**	**51870914**	**14623676**	**13910373**	**16705751**	**250256279**	

Source: Department of Tourism and Civil Aviation, Himachal Pradesh

APPENDIX-II

Mean Score of Selected Sustainability Indicators for PPP Ecotourism Sites

PPP Ecotourism Sites	Sustainability Indicators	Mean Rank
Aamod, Shoghi	9	52.89
Nature's Treat, Khalogra	9	33.28
Park Woods, Aanji	9	37.22
Pine Hills Eco-Camp, Chewa	9	26.17
Nature Camp, Sanawar	9	35.39
Aamod, Dalhousie	9	35.50
Nature Camp, Narkanda	9	41.56
Himalyan Nature Camp, Jalodi	9	30.00
Total	72	

Test Statistics	
Chi-Square	10.033
df	7
Asymp. Sig.	0.187

APPENDIX-III

Mean Score of Departmental Ecotourism Sites for Selected Sustainability Indicators as per Kruskal Wallis H test

Departmental ecotourism sites	Sustainability Indicators	Mean Rank
Eco-tourism site, Kasol	9	30.39
Eco-tourism site, Devidarh	9	33.11
Eco-tourism site, Prashar	9	26.67
Children's Park, Hamirpur	9	34.44
Eco-tourism site, Holi,	9	36.83
Eco-tourism site, Sahoo,	9	42.11
Eco-tourism site, Paneo	9	50.28
Nature Park, Jhiri	9	38.17
Total	**72**	

Test Statistics	
	VAR00002
Chi-Square	8.555
df	7
Asymp. Sig.	0.286

APPENDIX-IV

Mean Score of PPP and Departmental Ecotourism Sites for Selected Sustainability Indicators as per Mann Whitney U test.

Ranks				
Ecotourism Sites	**PPP Ecotourism Sites**	**Sustainability indicators**	**Mean Rank**	**Sum of Ranks**
Departmental Sites	1.00	9	8.11	73.00
	2.00	9	10.89	98.00
	Total	18		

APPENDIX-V

Ratings for Infrastructure Variables of PPP Ecotourism Sites

PPP Ecotourism Sites	Amount	Status	Functionality	Infrastructure management component
Aamod, Shoghi	4	4	1	60.0%
Nature's Treat, Khalogra	1	1	4	40.0 %
Park Woods, Aanji	5	3	3	73.3 %
Pine Hills Eco-Camp, Chewa	2	1	5	53.5 %
Nature Camp, Sanawar	2	3	4	60.0 %
Aamod, Dalhousie	2	2	3	77.78%
Nature Camp, Narkanda	3	2	5	66.67%
Himalyan Nature Camp, Jalodi	3	2	5	66.67%

APPENDIX-VI

Ratings for Infrastructure Variables of Department Ecotourism Sites

Departmental Ecotourism Sites	Amount	Status	Functionality	Infrastructure management component
Ecotourism site, Kasol	3	3	4	86.34%
Ecotourism site, Devidarh	2	2	2.5	72.20%
Ecotourism site, Prashar	3	3	2.5	94.40%
Children's Park, Hamirpur	1	1	5	51.23%
Ecotourism site, Holi,	1	2	4	58.33%
Ecotourism site, Sahoo,	1	2	5	53.33%
Ecotourism site, Paneo	1	2	5	53.33%
Nature Park, Jhiri	1	2	2	83.33%

APPENDIX-VII

Ratings for Equipment Variables of PPP Ecotourism Sites

PPP Ecotourism Sites	Amount	Status	Functionality	Equipment management component
Aamod, Shoghi	3	4	4	73.3 %
Nature's Treat, Khalogra	4	4	4	80.0%
Park Woods, Aanji	5	4	4	86.6 %
Pine Hills Eco-Camp, Chewa	4	4	4	80.0 %
Nature Camp, Sanawar	4	4	4	80.0%
Aamod, Dalhousie	4	3	3	83.33%
Nature Camp, Narkanda	1	1	1	77.78%
Himalyan Nature Camp, Jalodi	2	2	5	60.0%

APPENDIX-VIII

Ratings for Equipment Variables of Departmental Ecotourism Sites

Departmental Ecotourism Sites	Amount	Status	Functionality	Equipment management component
Ecotourism site, Kasol	2	3	3	83.33%
Ecotourism site, Devidarh	2	3	2.5	83.30%
Ecotourism site, Prashar	3	3	2.5	94.40%
Children's Park, Hamirpur	3	2.5	2	90.33%
Ecotourism site, Holi, Chamba	3	2	2	77.78%
Ecotourism site, Sahoo,	1	2	2	83.33%
Ecotourism site, Paneo	1	2	5	53.33%
Nature Park, Jhiri	2	3	3	88.88%

APPENDIX-IX

Ratings for Personnel Variables of PPP Ecotourism Sites

PPP Ecotourism Sites	Number	Educational Qualification	Experience	Training Received	Personnel management component
Aamod, Shoghi	5	4.9	4.4	4.6	91.6 %
Nature's Treat, Khalogra	3	4.2	3.6	1.5	65.2 %
Park Woods, Aanji	4	3.8	3.2	2.2	68.8 %
Pine Hills Eco-Camp, Chewa	3	4.1	2.7	2.2	64.0%
Nature Camp, Sanawar	3	4.2	2	2	60.8 %
Aamod, Dalhousie	4	5.5	4.8	4.47	99.7%
Nature Camp, Narkanda	3	4.28	2.71	2.14	60.87%
Himalyan Nature Camp, Jalodi	4	3.6	4	2	58.33%

APPENDIX-X

Ratings for Personnel Variables of Departmental Ecotourism Sites

Departmental Ecotourism Sites	Number	Educational Qualification	Experience	Training Received	Personnel management component
Eco-tourism site, Kasol	3	2	3	1	91.6 %
Eco-tourism site, Devidarh	2	3	3	3	83.33%
Eco-tourism site, Prashar	3	2.25	3	3	68.8 %
Children's Park, Hamirpur	1	3	3	1	64.0 %
Eco-tourism site, Holi,	3	3.6	3.4	2	87.5%
Eco-tourism site, Sahoo,	3	2.5	3.5	1	58.33%
Eco-tourism site, Paneo	3	3	4.5	3	70.0%
Nature Park, Jhiri	3	4.67	4.6	2.6	98.91%

APPENDIX-XI

Management Capacity Calculation for PPP Ecotourism Sites

PPP Ecotourism Sites	Infrastructure (%)	Equipment (%)	Personnel (%)	Management Capacity (%)
Aamod, Shoghi	60.0	73.3	91.6	74.96
Nature's Treat, Khalogra	40.0	80.0	65.2	61.73
Park Woods, Aanji	73.3	86.6	68.8	76.23
Pine Hills Eco-Camp, Chewa	53.3	80.0	64.0	41.76
Nature Camp, Sanawar	60.0	73.3	91.6	74.96
Aamod, Dalhousie	77.78	83.33	99.70	86.93
Nature Camp, Narkanda	66.67	77.78	60.87	68.44
Himalyan Nature Camp, Jalodi	66.67	60.00	58.33	61.67

APPENDIX-XII

Management Capacity Calculation for Departmental Ecotourism Sites

Departmental Ecotourism Sites	Infrastructure (%)	Equipment (%)	Personnel (%)	Management Capacity (%)
Eco-tourism site, Kasol	86.34	83.33	91.6	87.09
Eco-tourism site, Devidarh	72.28	83.33	83.33	79.62
Eco-tourism site, Prashar	94.40	94.40	93.75	94.21
Children's Park, Hamirpur	51.23	90.33	64.0	85.00
Eco-tourism site, Holi,	58.33	77.78	87.50	74.54
Eco-tourism site, Sahoo,	53.33	83.33	58.33	64.99
Eco-tourism site, Paneo	53.33	53.33	70.00	58.89
Nature Park, Jhiri	83.33	73.33	98.81	85.19

APPENDIX-XIII

Land Suitability Criteria for Ecotourism Site Identification in Chirgaun block of District Shimla, Himachal Pradesh
Elevation range: 1539 – 5452m
Slope: 0 – 83^{o}

Sr. No.	Criteria	Classes	Ranking	Suitability
1	Slope (Degree)	0 - 15	1	Highly suitable
		15 - 25	2	Moderately suitable
		25 - 40	3	Marginally suitable
		More than 40	4	Not suitable
2	Elevation (Meters)	1500 – 3000m	1	Highly suitable
		3000 – 4000m	2	Moderately suitable
		4000 – 4500m	3	Marginally suitable
		More than 4500m	4	Not suitable
3	Aspect (Direction)	South	1	Highly suitable
		East	2	Moderately suitable
		West	3	Marginally suitable
		North	4	Not suitable
4	Water Availability (Distance in Km)	Less than 1Km	1	Highly suitable
		1Km – 1.5Km	2	Moderately suitable
		1.5Km – 2Km	3	Marginally suitable
		More than 2Km	4	Not suitable
5	Accessibility (Distance from nearest road in Kilometer)	Less than 2Km	1	Highly suitable
		2 – 3Km	2	Moderately suitable
		3 – 5Km	3	Marginally suitable
		More than 5Km	4	Not suitable
6	LULC (Classes)	Grassland	1	Highly suitable
		Forest	2	Moderately suitable
		Horticulture and Barren/rocky area	3	Marginally suitable
		Snow, Glacier, Agriculture fields, Water body, build up	4	Not suitable
7	Population (Size in number)	Less than 100	1	Highly suitable
		100 – 300	2	Moderately suitable
		300 – 500	3	Marginally suitable
		More than 500	4	Not suitable
8	Tourist Spots (Distance in Kilometer)	Less than 5 Km	1	Highly suitable
		5 – 10 Km	2	Moderately suitable
		10 – 15 Km	3	Marginally suitable
		More than 15	4	Not suitable

APPENDIX-XIV

Land Suitability Criteria for Ecotourism Site Identification in Kalpa block of District Kinnaur Himachal Pradesh
Elevation range: 1700 - 4500
Slope: 0 – 83.88^{o}

Criteria/Factors	Classes	Ranking	Suitability
Slope (Degree)	0– 15	1	Highly suitable
	15– 25	2	Moderately suitable
	25– 40	3	Marginally suitable
	More than 40	4	Not suitable
Elevation (Meters)	1700-3600	1	Highly suitable
	3600-4000	2	Moderately suitable
	4000-4500	3	Marginally suitable
	More than 4500	4	Not suitable
Aspect (Direction)	South	1	Highly suitable
	East	2	Moderately suitable
	West	3	Marginally suitable
	North	4	Not suitable
Water Availability (Distance in Km)	Less than 1Km	1	Highly suitable
	1Km – 1.5Km	2	Moderately suitable
	1.5Km – 2Km	3	Marginally suitable
	More than 2Km	4	Not suitable
Accessibility (Distance from nearest road in Kilometer)	Less than 2Km	1	Highly suitable
	2Km – 3Km	2	Moderately suitable
	3Km – 5Km	3	Marginally suitable
	More than 5Km	4	Not suitable
LULC (Classes)	Grassland	1	Highly suitable
	Forest	2	Moderately suitable
	Horticulture and Barren/rocky area	3	Marginally suitable
	Snow, Glacier, Agriculture, Water body, build up area	4	Not suitable
Population (Size in number)	Less than 100	1	Highly suitable
	100 – 300	2	Moderately suitable
	300 – 500	3	Marginally suitable
	More than 500	4	Not suitable
Tourist Spots (Distance in Kilometer)	Less than 5 Km	1	Highly suitable
	5 – 10 Km	2	Moderately suitable
	10 – 15 Km	3	Marginally suitable
	More than 15	4	Not suitable

APPENDIX-XV

Land Suitability Criteria for Ecotourism Site Identification in Seraj Block of District Mandi, Himachal Pradesh
Elevation range: 886 – 3338 meter
Slope: 0 – 73^{o}

Sr. No.	Criteria	Classes	Ranking	Suitability
1	Slope (Degree)	0 - 15	1	Highly suitable
		15 - 25	2	Moderately suitable
		25 - 40	3	Marginally suitable
		More than 40	4	Not suitable
2	Elevation (Meters)	More than 2000	1	Highly suitable
		1500 - 2000	2	Moderately suitable
		1200 - 1500	3	Marginally suitable
		886 - 1200	4	Not suitable
3	Aspect (Direction)	South	1	Highly suitable
		East	2	Moderately suitable
		West	3	Marginally suitable
		North	4	Not suitable
4	Water Availability (Distance in Km)	Less than 1Km	1	Highly suitable
		1Km – 1.5Km	2	Moderately suitable
		1.5Km – 2Km	3	Marginally suitable
		More than 2Km	4	Not suitable
5	Accessibility (Distance from nearest road in Kilometer)	More than 1.5Km	1	Highly suitable
		1 – 1.5Km	2	Moderately suitable
		0.5 – 1Km	3	Marginally suitable
		Less than 0.5Km	4	Not suitable
6	LULC (Classes)	Grassland	1	Highly suitable
		Forest	2	Moderately suitable
		Horticulture and Barren/rocky area	3	Marginally suitable
		Snow, Glacier, Agriculture fields, Water body, build up	4	Not suitable
7	Population (Size in number)	Less than 100	1	Highly suitable
		100 – 300	2	Moderately suitable
		300 – 500	3	Marginally suitable
		More than 500	4	Not suitable
8	Tourist Spots (Distance in Kilometer)	Less than 5 Km	1	Highly suitable
		5 – 10 Km	2	Moderately suitable
		10 – 15 Km	3	Marginally suitable
		More than 15	4	Not suitable

APPENDIX-XVI

Land Suitability Criteria for Ecotourism Site Identification in Bharmaur Block of District Chamba, Himachal Pradesh
Elevation range: 1282 – 6055m
Slope: 0 – 80.5^{o}

Sr. No.	Criteria	Classes	Ranking	Suitability
1	Slope (Degree)	0 - 15	1	Highly suitable
		15 - 25	2	Moderately suitable
		25 - 40	3	Marginally suitable
		More than 40	4	Not suitable
2	Elevation (Meters)	1500 – 3000m	1	Highly suitable
		3000 – 4000m	2	Moderately suitable
		4000 – 4500m	3	Marginally suitable
		More than 4500m 1282 - 1500	4	Not suitable
3	Aspect (Direction)	South	1	Highly suitable
		East	2	Moderately suitable
		West	3	Marginally suitable
		North	4	Not suitable
4	Water Availability (Distance in Km)	Less than 1Km	1	Highly suitable
		1Km – 1.5Km	2	Moderately suitable
		1.5Km – 2Km	3	Marginally suitable
		More than 2Km	4	Not suitable
5	Accessibility (Distance from nearest road in Kilometer)	Less than 2Km	1	Highly suitable
		2 – 3Km	2	Moderately suitable
		3 – 5Km	3	Marginally suitable
		More than 5Km	4	Not suitable
6	LULC (Classes)	Grassland	1	Highly suitable
		Forest	2	Moderately suitable
		Horticulture and Barren/rocky area	3	Marginally suitable
		Snow, Glacier, Agriculture fields, Water body, build up	4	Not suitable
7	Population (Size in number)	Less than 100	1	Highly suitable
		100 – 300	2	Moderately suitable
		300 – 500	3	Marginally suitable
		More than 500	4	Not suitable
8	Tourist Spots (Distance in Kilometer)	Less than 5 Km	1	Highly suitable
		5 – 10 Km	2	Moderately suitable
		10 – 15 Km	3	Marginally suitable
		More than 15	4	Not suitable

APPENDIX-XVII

Land Suitability Criteria for Ecotourism Site Identification in Sangrah Block of District Sirmaur, Himachal Pradesh
Elevation range: 586 – 3569m
Slope: 0 – 78^{o}

Sr. No.	Criteria	Classes	Ranking	Suitability
1	Slope (Degree)	0 - 15	1	Highly suitable
		15 - 25	2	Moderately suitable
		25 - 40	3	Marginally suitable
		More than 40	4	Not suitable
2	Elevation (Meters)	More than 2000	1	Highly suitable
		1500 - 2000	2	Moderately suitable
		1200 - 1500	3	Marginally suitable
		586 - 1200	4	Not suitable
3	Aspect (Direction)	South	1	Highly suitable
		East	2	Moderately suitable
		West	3	Marginally suitable
		North	4	Not suitable
4	Water Availability (Distance in Km)	Less than 1Km	1	Highly suitable
		1Km – 1.5Km	2	Moderately suitable
		1.5Km – 2Km	3	Marginally suitable
		More than 2Km	4	Not suitable
5	Accessibility (Distance from nearest road in Kilometer)	More than 1.5Km	1	Highly suitable
		1 – 1.5Km	2	Moderately suitable
		0.5 – 1Km	3	Marginally suitable
		Less than 0.5Km	4	Not suitable
6	LULC (Classes)	Grassland	1	Highly suitable
		Forest	2	Moderately suitable
		Horticulture and Barren/rocky area	3	Marginally suitable
		Snow, Glacier, Agriculture fields, Water body, build up	4	Not suitable
7	Population (Size in number)	Less than 100	1	Highly suitable
		100 – 300	2	Moderately suitable
		300 – 500	3	Marginally suitable
		More than 500	4	Not suitable
8	Tourist Spots (Distance in Kilometer)	Less than 5 Km	1	Highly suitable
		5 – 10 Km	2	Moderately suitable
		10 – 15 Km	3	Marginally suitable
		More than 15	4	Not suitable

APPENDIX-XVIII

Pair Wise Matrix Analysis of Selected Criteria for Potential Ecotourism Area Identification

Criterias	LULC (a)	Topography (b)	Accessibility (c)	Water (d)	Population Size (e)	Tourist Spots (f)	Sum	Product (a to f)=k	k^(1/6)	M2 (Weights)	M3 = M*M2 (Suitability)	M4 = M3/M2 (Consistency)
LULC	**1.000**	3.000	5.000	0.333	5.000	7.000	21.33	174.825	2.365	0.28	1.755	6.317
Topography	0.333	**1.000**	3.000	0.166	2.000	5.000	11.49	1.660	1.088	0.13	0.799	6.248
Accessibility	0.200	0.333	**1.000**	0.142	0.333	2.000	4.00	0.006	0.430	0.05	0.308	6.103
Water	3.000	4.000	6.000	**1.000**	4.000	7.000	25.00	2016.000	3.554	0.42	2.675	6.408
Population Size	0.200	0.500	3.000	0.250	**1.000**	3.000	7.95	0.225	0.780	0.09	0.571	6.238
Tourist spots	0.143	0.200	0.500	0.143	0.333	**1.000**	2.31	0.001	0.297	0.03	0.215	6.186
Sum	**4.876**	**9.033**	**18.500**	**2.034**	**12.666**	**25.000**	72.11		**8.513**	**1.00**	**6.323**	**6.250**

M = Matrix

Dr. Y.S. Parmar University of Horticulture and Forestry
(Nauni) Solan (HP) - 173 230
Department of Environmental Science

Title of Thesis	**:**	**"Sustainability Assessment and Identification of Ecotourism Sites in Himachal Pradesh"**
Name of the Student	**:**	Shalini Chauhan
Admission Number	**:**	F-2017-10-D
Major Field(s)	**:**	Environmental Science
Minor Field(s)	**:**	i) Social Science ii) Soil Science and Water Management
Date of Submission	**:**	17-11-2021
No. of pages in thesis	**:**	163+xi
No. of words in abstract	**:**	610
Major Advisor	**:**	Prof. S.K. Bhardwaj

ABSTRACT

The investigation entitled **"Sustainability Assessment and Identification of Ecotourism Sites in Himachal Pradesh"** was conducted during the year 2018-2020 in the Department of Environment Science of Dr. YS Parmar University of horticulture and Forestry, Nauni, Solan (HP). The study was aimed to assess the ongoing ecotourism activities in Himachal Pradesh for sustainability and further to identify new sites along with a strategic plan for viable establishment and development of ecotourism industry in the state. Sixteen ecotourism sites operating in People Public Partnership (PPP) and Departmental mode were assessed for sustainability by considering UNWTO indicators; carrying capacity and water quality. To further strengthen and expand the industry, study was also conducted to identify new potential areas for which five blocks were selected randomly. AHP technique along with remote sensing and GIS were used for the purpose. To develop strategies for the sustainable establishment, growth and expansion of the ecotourism industry SWOT technique was applied. Amongst the PPP sites Aamod, Shoghi with a mean rank of 53.33 was found to be the least sustainable while Pine Hills Eco-Camp, Chewa with a mean rank of 26.83 was found to be the most sustainable. Amongst the Departmental sites, Ecotourism Site at Paneo (50.28) was least sustainable and Ecotourism Site, Prashar (26.67) was found to be the most sustainable. Overall, PPP sites with a mean rank of 8.11 were found to be more sustainable than the Department ecotourism sites with a mean rank of 10.89. Out of the total selected sustainability indicators potable water demand with a total indicator score of 28 was highly impacted and local employment indicator (15) was found to be least affected by PPP ecotourism activities. Correspondingly, energy consumption and waste management indicator were found to be highly impacted by Departmental activities with a total indicator score of 30 each while bio-capacity (17) was observed to be least impacted. Departmental sites have higher ECC (1150 visitors^{-day}) than the PPP sites with ECC of 368 visitors^{-day}. The ECC amongst the PPP sites ranged from 143 visitors^{-day} for Nature Camp, Narkanda to 1079 visitors^{-day} for Park Woods, Aanji. For Departmental sites the ECC ranged from 120 visitors^{-day} for Ecotourism Site, Prashar to 3635 visitors^{-day} for Ecotourism Site, Kasol. With the current rate of tourist inflow in the state, the sustainability status of the ecotourism sites in terms of carrying capacity may start to deteriorate in the next 26-27 years on account of inefficient management capacity. Ecotourism sites in Himachal Pradesh have wide scope of improvement and accommodating more tourists in terms of ECC. The water quality parameters were found well within the permissible limit. Amongst the blocks selected for identifying new ecotourism areas, Sangrah was found to have maximum area (11.16%) and Chirgaun to have minimum area (3.05%) under highly suitable class that accounts for around 53.41 km^2 and 30.18 km^2 of the total block area respectively. The southern aspect area falling under grassland LULC with slope less than 15^o, having a perennial water source within 1.5 km and surrounding population size of less than 150 can be developed into an ecotourism site. For sustainable development of ecotourism industry in the state, SWOT analysis indicated need for strengthening adoption of renewable energy sources, environment friendly infrastructure, scientific waste management, establishing and developing new potential ecotourism sites along with enhancing community involvement in terms of decision making, employment and other ecotourism activities. Furthermore, multi-sectoral approach for planning, implementation and monitoring along with planned promotion and marketing will boost the ecotourism industry in the region. It is concluded from the study that the state ecotourism industry has great potential for expansion, the sustainability of which may be ensured by the adoption of environment cordial practices.

Signature of the Major Advisor **Signature of the Student**

Countersigned

Professor and Head
Department of Environmental Science
Dr Y. S. Parmar University of Horticulture and Forestry
(Nauni) Solan (HP) – 173 230

BRIEF BIO-DATA

Name : Shalini Chauhan

Father name : Sh. MS Chauhan

Mother name : Smt. Sulachna Chauhan

Date of Birth : 30th May 1989

Sex : Female

Permanent Address : Village: Rohi, PO: Jamun Ki Ser, Teh: Pachhad, Distt: Sirmaur, Himachal Pradesh, India. (173024)

Academic Qualifications:

Particulars	Month & Year	School	Board/University	Marks (%)	Division
High School	June, 2005	Chinmaya Vidyalaya, UHF Campus Nauni	Central Board of Secondary Education	70.8	First
Secondary School	June, 2007	GSSS Sarahan, Sirmaur, HP	Himachal Pradesh Board of School Education	60.3	First
B.Sc. (Forestry)	June, 2011	College of Forestry	Dr Y S Parmar University of Horticulture and Forestry Nauni, Solan (HP)	76.8	First
M.Sc (Forestry) Environment Management	October, 2013	College of Forestry	Dr Y S Parmar University of Horticulture and Forestry Nauni, Solan (HP)	78.9	First

Fellowship/Scholarship/Goldmedal/ Awards/ Any other distinction : National Mission on Himalayan Studies (NMHS), MoEFCC, GOI Fellowship during PhD Programme

Publications : **5** + (2 submitted)

(**Shalini Chauhan)**