ANALYSIS OF THE ENVIRONMENTAL SUSTAINABILITY OF TOURISM INFRASTRUCTURE DEVELOPMENT AT YANKARI GAME RESERVE, BAUCHI - NIGERIA

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BY

BUHARI; MOHAMMED DANLAMI
M.SC/ENV-DES/ 17232/2007-2008

A Thesis Submitted to the Post Graduate School Ahmadu Bello University Zaria, in Partial Fulfillment of the Award of Master of Science in Tourism and Recreation Planning.

Department of Urban and Regional Planning

Ahmadu Bello University, Zaria, Nigeria

August. 2012

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DECLARATION

I declared that the work in this thesis entitle 'ANALYSIS OF THE ENVIRONMENTAL SUSTAINABILITY OF TOURISM INFRASTRUCTURE DEVELOPMENT AT YANKARI GAME RESERVE, BAUCHI, NIGERIA Has been performed by me in the Department of Urban and Regional Planning under the supervision Professor J.B. Kaltho and Mr. E.S. Lema.

The information derived from literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for the award of another Degree or Diploma at any university.

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Buhari Mohammed Danlami

Name of Student Sign Date

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CERTIFICATION

This thesis entitle 'Analysis of the Environmental Sustainability of Tourism Infrastructure Development at Yankari Game Reserve, Bauchi Nigeria by Buhari Mohammed Danlami meets the regulations governing the award of Degree of Master of Science of Ahmadu Bello University, Zaria and is approved for its contributions to knowledge and literary presentation

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Prof. J.B. Kaltho Date

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DEDICATION

This work is dedicated to Almighty Allah who in His infinites mercies saw me through the entire programme from its beginning to the end and Mal. Aminu Musa Yusuf DG/CE NITT for the support through out the programme.

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Abstract

Development of tourism Infrastructure at the Yankari Game Reserve,Bauchi, which is essentially a natural environment, raises obvious questions about its future in terms of the sustainability of wildlife conservation and biodiversity objectives and the provision of tourism and recreation. The research set out to answer the question, Has tourism infrastructure already passed some critical environmental thresholds? Will tourism infrastructure endanger the ecological well-being of Yankari Game Reserve? These are questions about how much change in terms of infrastructure provision is acceptable for sustainability of the Game Reserve. This thesis tries to address these questions at the Game Reserve Basecamp using the Limits of Acceptable Change (LAC) framework. Limits to change are examined by first surveying the status of the existing Infrastructure at the Basecamp, then the proposed development to be put in place and then the attitudes of tourism stakeholders and tourists toward present and future ecological conditions. Whereas tourists and non-tourists generally view present conditions as unacceptable in the study area, increased development raises red flags in the minds of both those who know the Game Reserve and tourists, especially at the Basecamp of the study area. Both tourists and non-tourists believed that more infrastructure development will lead to "change for the worse" in a wide range of environmental impact variables. On the other hand, all respondents agreed strongly that development and pristine environment pulls apart and that more infrastructure development in the Game Reserve would conflict with Game Reserve objectives. They however agreed that siting such facility in neighboring village such as Dindima and Mai-Namaji will bring more benefit to the community

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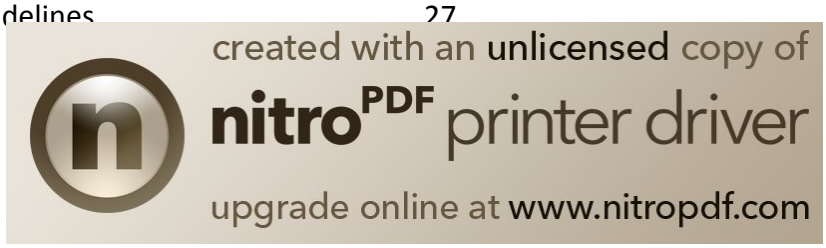
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CHAPTER ONE

BACKGROUND OF THE STUDY

1.0 Introduction

Yankari Game Reserve is first and foremost a protected area/Wildlife Game Reserve whose main objective is conservation of flora and fauna thereby maintaining nature for promotion of biodiversity. The complementary objective is the provision of Tourism and Recreation. It is therefore a tourist destination where the diversity and arrangement of land use should be design to enhance quality of Game viewing experience and the long time sustainability of the Game Reserve. The land use must therefore complement each other aesthetically, socially, economically and environmentally

The environment is the main base for the natural and cultural resources for attracting tourists' worldwide (Bonn, Joseph, & Dai, 2005; Smits & Shousha, 1998). Therefore, the conservation of environmental resources is very necessary for the long-term success of a wildlife Game Reserve.

The main point is to satisfy the tourist's needs and without destroying the Game Reserve resources for the benefit of future generations.

The success of Game Reserve infrastructure management will depend on the extent to which undesirable environmental effects of tourism development and tourist activities are prevented or minimized in order to guarantee a certain level of quality wildlife viewing experience. This can be achieved by maintaining biodiversity, protecting tourism resorts, other exploitative resource uses, generating revenue for local people (Benavides & Perez-Ducy, 2001; Gunn, 1994; Horochowski & Moisey, 2001; Ludwig, Hilborn, & Walters, 1993;

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For sustainability purpose, it is necessary to limit consumption of Game Reserve natural resources, limit destination space, and limit pollution size. In short, it is important to limit and control tourism Infrastructure development based on mass tourism strategy and expand high quality tourism for achieving the sustainability requirements (Ono, 1993; world Bank, 1992; UN ESCAP, 2001; United Nation, Environment Program, 2002).

Four basic principles of development of tourism in Game Reserve areas or parks that have been identified are: (1) Encourage conservation (2) Provide benefits to the local population (3) Provide quality visitor experience. (4) Development is not to exceed limits of acceptable change (ESCAP Review: 2005).

Game Reserve development is almost always associated with tourism owing to the potentials offered. However, the basic truth about tourism development in protected areas is that: It consumes resources, creates waste and requires certain kinds of infrastructure. It creates conditions for possible over-consumption of resources; and is dominated by private investment with priority on maximizing profit. Its multi-faceted nature makes control difficult; and it may be seen as simply entertainment services consumed by tourists.

The infrastructure for tourism includes basic components like airports, railways, roads, electricity, water supply, drainage, sewerage, solid waste disposal systems, and services. Additionally, facilities like accommodation, restaurants, and recreational facilities and shopping facilities come under the ambit of tourism infrastructure. Tourism infrastructure demand for goods and services, and the establishments that provide services are considered part of infrastructure for the tourism industry. That is it includes establishments whose products are mainly sold to visitors. Such as power, telecommunication, water supply, roads and some

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production sectors like travel items, sports equipment; photographic materials, medicines and cosmetics.

Sustainable development of tourism infrastructure clearly, involves the integrated development of basic infrastructure and amenities in a balanced manner (Ouhart, Horoschowsky, ibid).

Carrying capacity is a key approach in planning for sustainable tourism infrastructure development and Game Reserve resources management. The "best practice" to manage environment resources is to maximize the use that can be made of a tourist site without causing detrimental effects on its tourism resources, decreasing tourist satisfaction level, or causing socioeconomic problems for the local community. This, of course, is the intrinsic problem of carrying capacity. Any level of use leads to some detrimental effects. Thus, the key question is not how to provide tourism in wildlife Game Reserve- without causing detrimental effects, but rather determining how acceptable such effects may be Gezt1987).

Getz (1987) identified six different approaches of interpretations or methods of determining carrying capacity:

a. Limits to Acceptable change,

b. Tolerance by the Host Population,

c. Satisfaction of Visitors,

d. Excessive Rate of Growth of Change, and

f. Capacity based on the evaluation of costs and benefits,

g. The role of Capacity in a Systems Approach.

In recent times the interest on carrying capacity has shifted from an "objectively" assessed threshold to –policy useful- *desired conditions* providing more advantages to planning and decision making.

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1.1 Statement of the problem

The environmental system in Yankari Game Reserve is being threatened with infrastructure development by the Bauchi state Government, the environmental and natural serenity of the Game Reserve in particular is being compromised. There is indication that the proposed construction and provision of accommodation, student hostels, conference centre, and the proposed upgrading of Airstrip, the proposed construction of a Theme park, and a world class Golf course and the upgrading of roads, in addition a 4 to 5 Star statue hotel is also being considered for development. These development will further compromise the attainment of ecological preservation, conservation of wildlife and biodiversity which is the goal of natural Reserve, The assumption is that such facilities in a natural environment like Yankari Game Reserve is that it would raise the level of generation of waste and noise, destruction of vegetation, and the continuous presence of human activity thereby disturbing the wildlife and biodiversity.

Consequently, the dilemma or challenge facing infrastructure development in the Game Reserve is how to achieve a balance between the potential developmental contribution of infrastructure and its negative consequences or, more simply, how to manage effectively the development of tourism

It is on the basis of this that the following problems are observed:

i. Tourist accommodation is out of character with an essentially natural area being often visually intrusive and potentially polluting,
ii. Tourist accommodation have an in built potential to grow and once established, it requires a deliberate effort to restrain; and

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iii. Tourism development requires a range of services, and for Yankari Game Reserve, they are brought in by road, which creates a secondary impact on the protected area

iv. The centre of tourist activity is within the protected area if it was outside and near established settlements, it would be easier to bring greater benefit to local people;

v. The process of expansion and modernisation of infrastructure recently commenced is distorting the natural aesthetics and serenity of the Game Reserve habitat;

vi. The Bauchi State Tourism Board is not clearly decided on how much infrastructure provision the Game Reserve can accommodate without altering its natural quietness?

This study is therefore an attempt to determine the existing tourism infrastructure compliment in Yankari Game Reserve. Appropriate criteria and practical considerations are to be determined and used for identification of the requirements that will form a basis for environmental sustainability of tourism development in the Reserve.

With this focus, the research shall attempt to answer the question:

i. Will tourism infrastructure endanger the ecological and natural serenity of Yankari Game Reserve?

ii. Has Yankari Game Reserve approaches its Limits to Acceptable change for infrastructure provision for environmental sustainability?

The question relates to the following selected items:

- Volume of tourist visits that can be accommodated by Infrastructure without exceeding limits for acceptable use that is environmentally sustainable:

The question shall be analysed against a set of Game Reserve environmental sustainability criteria that is infrastructure development objectives, limits of acceptable change, carrying capacity threshold and resource/environn

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1.2 Aim

The aim of the study is to appraise the provision of tourism infrastructure in Yankari Game Reserve with a view to determining the limits of use that is environmentally sustainable.

1.3 Objectives

i. To review the concept and principles of the Limits to Acceptable change planning system and the role of tourism infrastructure as well as the criteria for setting limits for sustainable provision and use.

ii. To appraise the status of existing and proposed/future tourism infrastructure provision in Yankari Game Reserve.

iii. To determined tourist and non-tourist perception of infrastructure development in a Wildlife Game Reserve

iv. To determine the levels of development based on the selected methods of determining limits of acceptable use in Yankari Game Reserve.

v. To make policy recommendations for ensuring environmentally sustainable infrastructure development in the Game Reserve.

1.4 Scope and Delimitation of the study

This study covers the analysis of the adequacy or otherwise of the entire tourism infrastructure in Yankari Game Reserve based on environmental sustainability criteria. However, the delimitation is the infrastructure provision in the Camp Base including the roads and trails provision within the Reserve.

The contribution of the study shall indeed be attained with the analysis being based on selected items of infrastructure and environmental sustainability criteria.

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1.5 The Study Area

Yankari Game Reserve is a wildlife park located in the south-east part of Bauchi state, Nigeria. It covers an area of about 2,244 km² (870 m²) of uninhabited savannah woodland, at an elevation of approximately 2429-4164 meters, and is home to several natural warm water springs, as well as a wide variety of flora and fauna. Its location in the heartland of the West African savannah makes it unique for tourists and holidaymakers to watch wildlife in its natural habitat.

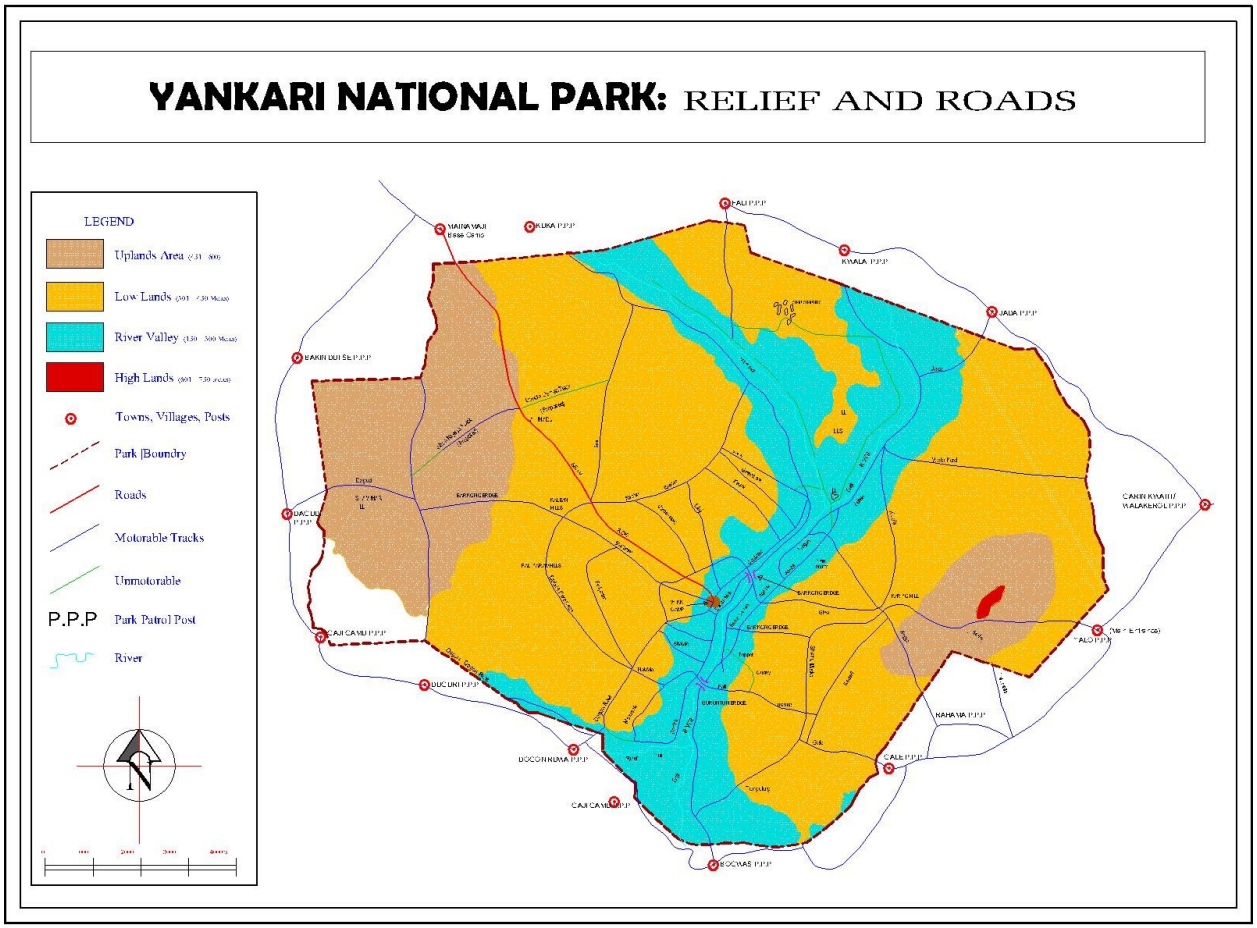
Yankari was set up in 1956 and opened to the public in 1962, designated and opened as Nigeria's biggest national park in 1991. It is the most popular destination for tourists in Nigeria and the West African sub-region and plays a crucial role in the development and promotion of tourism in Nigeria because of its rich wildlife resources

The park is an important refuge for over 50 species of mammals including African Bush elephant, olive Baboons, Patas, monkeys, Tantalus, Western Hartebees,Lions, African Buffalos, Water bucks, Bush bubucks, and hippopotamus. It also has a large and diverse freshwater ecosystem around its freshwater springs and the Raji River.

In 2000, Yankari Game Reserve hosted over 20,000 tourists from over 100 countries. This places it among the most popular tourist destinations in Nigeria and, if the tourism infrastructure is properly analysed and appropriate recommendations for their sustainable development made, it could become a significant part in the development and promotion of tourism throughout Nigeria. It is one of a few remaining areas left in West Africa where wild animals are protected in their natural habitat.



The Reserve's main entrance is at Mainamaji village, about 29km from Dindima. It is located within the Duguri, Pali and Gwana districts of Alkaleri Local Government Area of Bauchi State. This LGA has a population 208,202 people occupying a total land area of 7,457.78 km².



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1.6 Significance of the Study

In Nigeria, tourism and recreation planning is a new field of study. Not much attention has been given to the analysis of sustainable tourism infrastructure development. Therefore; this study contributes to the on–going debate on the analysis and planning for integrated physical infrastructure component and amenities in an environmentally sustainable manner.

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CHAPTER TWO

LITERATURE REVIEW

2.0 Concept and principles of LAC, criteria and Methods of Analysis

Well designed camping facilities, such as these in Taroko National Park, Taiwan, provide valuable Services to the park visitors, as well as protect the environment through environmentally sensitive design.

2.1 The Limits to Acceptable Change planning system as applied to Game Reserve

While the biophysical characteristics of many Game Reserves remain the fundamental rationale for their initial designation, it has become quite clear that the values for which these areas were initially protected can be threatened by unmanaged or poorly managed recreational use e.g. unchecked human activity leading to the spread of development.

The Limits of Acceptable Change (LAC) planning system was initially designed to address visitor management issues in the U.S. National Wilderness Preservation System and was a product of the spreading realisation that "Carrying Capacity" failed in achieving its objectives. While there are many reasons why the carrying capacity paradigm failed, the most fundamental was that it impelled managers toward the wrong question: "How many is too many?" Carrying capacity is intrinsically a quantitative term, yet, research was showing that many problems of recreational use were a function not so much of numbers of people, but their behaviour.

LAC, on the other hand, deals with a significantly different question: "What **resource** and **social conditions** are appropriate (or **acceptable**), and how do we attain those conditions?" This question represented a substantially different approach to thinking about recreational use

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questions, yet was actually more closely aligned with the principal job of recreation managers – protecting the values for which an area was established – than the carrying capacity paradigm.

Thus, Limits of Acceptable Change as a planning system was viewed as a way for managers to confront and resolve the complex issues of managing visitors to not only provide for the experiences they seek, but to deal with the problems of their social and biophysical impacts.

The LAC system is, in effect, built upon eleven principles that have emerged from research on visitor impacts and growing public interest to be involved in protected area decision-making.

The LAC unmistakably is recognised as a fundamental component of any systematic planning system for natural area protection and management (Paul FGE,1989). In the context of environmental sustainability of a Wildlife Game Reserve

2.2 Principles

2.2.1 Appropriate management depend upon objectives

A clear and consistent theme expressed throughout the literature of visitor management in Game Reserve has been the need for explicitly stated objectives. Objectives provide definitive statements of the products or outcomes of recreation or Game Reserve management. Objectives, either as formal statements of legislative or administrative policy or as explicit assertions in a management plan identify the appropriateness of management actions and indicate acceptable resource and social conditions**.** Formally stated objectives allow Game Reserve managers to determine how successful management actions may have been in resolving problems.

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2.2.2 Diversity in Resource and Social Conditions in protected areas is inevitable and may be desirable

Resource and social conditions within any relatively large Game Reserve are not likely to be uniform. Impacts, use levels, and expectations of appropriate conditions tend to vary. Topography, vegetation and access influence use densities and level of impact. Visitor use is frequently unevenly distributed. This diversity of conditions is inevitable, and sometimes desirable. For example, in large Game Reserves areas, it generally would not be desirable or acceptable to have developments spread evenly across the area, leaving no place untouched.

2.2.3 Management is directed at influencing Human induced Change

Many Game Reserves have been established to protect not only unique and valuable natural features and conditions, but natural processes as well. Management is generally oriented toward limiting and managing human-induced changes in these areas. It is human-induced changes, such as infrastructure development, that we find most disturbing in protected areas. These human-induced changes may lead to conditions that visitors or managers may feel are unacceptable or inappropriate. Management then concerns itself with determining what actions will be effective in influencing the amount, type and location of these changes in addition to determining how much change is acceptable.

2.2.4 Impacts on Resource and Social conditions are inevitable consequence of human use

A variety of research has shown that relatively small amounts of recreational use in terms of tourist accommodation leads to disproportionately large biophysical impacts, Thus, allowing any level of development for recreational use in a protected area means that some level of impact

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will occur. The principal question that managers must ask is "how much impact is acceptable in this area?" Once this question has been addressed, managers must then deal with the appropriateness of various techniques or actions to manage to this level of impact. In a similar way, social impacts often occur with relatively small amounts of use. For example, a few people behaving in a rowdy manner may impact another visitor's experience far more than many people being quieter. This principle extends to types of visitors as well.

2.2.5 Impacts may be temporal or spatially discontinuous

Impacts from infrastructure development, use and management activities may occur offsite and may not be visible until later. For example, a management strategy of building visitor facility in a protected area may simply transfer impacts to potentially more sensitive areas. Inefficient water treatment may result in pollution of water downstream from the outlet. And, impacts, from infrastructure use such as dying vegetation, and loss of a wildlife species may not be visible until long after, such tendencies make understanding and managing impacts from infrastructure development significantly more difficult.

2.2.6: Many variables influence the Use/Impact Relationship

While the level of recreational use is an important consideration in managing protected areas, a variety of other variables affect the use/impact relationship. For example, it has long been known that behaviour of recreationists influences the amount of impact they cause. In marine settings, treading water with flippers may stir up sand that may impact coral. Other variables include travel method, group size, season of use, and a variety of soil and vegetation characteristics. Similarly, there may be coral settings that are more or less sensitive to recreational use. What this principle means is that the standard errors around lines depicting use/impact relationships will be

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extremely large because of these other factors and that attempts to control human-induced impacts solely through use limits or carrying capacities may fail. Education and information programs and regulations aimed at changing visitor behaviour may be more effective.

2.2.7: Management problems are not use Density Dependent

Management problems that relate to the number of people using an area tend to be those that have relatively simple technological solutions, such as sewage, water supply and parking. Even for some of these, however, the intensity of the problem may not be linearly related to amount of use. For example, *per capita* consumption of water for sewage disposal may be reduced by using toilets with low water requirements. The lack of a precise linear relationship between use and biophysical impact implies that management problems are not density dependent.

2.2.8: Limiting use is only one of many management options

One of the problems with the carrying capacity approach is its emphasis on controlling or limiting the number of visitors as a key to limiting impacts (Stankey and McCool 1991). Because carrying capacity carries with it the question "how many is too many?," It tends to view imposition of use limits as an end in itself.

A use limit policy is only one of a number of potential management actions that are available to address visitor impacts, yet is one of the most intrusive actions that managers could deploy. Use limit policies have historically carried with them a host of additional problems, such as choosing appropriate allocation and rationing techniques. These techniques have been among the most controversial actions protected area managers have ever taken.

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Table 1: IUCN Categorisation of protected area

Category	*Purpose*	Objective	Description
CATEGORY Ia:	*Strict Nature Reserve*	protected area managed mainly for science	Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.
Category Ib:	Wilderness Area	protected area managed mainly for wilderness protection	Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
Category II:	National Park/Game Reserve	protected area managed mainly for ecosystem protection and recreation	Natural area of land designated to a) protect the ecological integrity of one or more ecosystems for present and future generations, b) exclude exploitation or occupation inimical (harmful) to the purposes of designation of the area, and c) provide a foundation for spiritual, scientific, educational, tourism and recreational and visitor opportunities, all of which must be environmentally and culturally compatible .

Source:DN Cole,1999

Yankari Game Reserve falls under category11 of the IUCN categorisation of natural areas/ protected area.Table 3 shows that some kind of tourism and recreation is likely to occur as a management objective, it also shows that biodiversity protection, though a critically important

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function of many protected areas, is far from the only purpose and is often not the primary purpose of a Game Reserve, the main purpose and objective of this category of Game Reserve is managed mainly for ecosystem protection and recreation

2.3 Infrastructure

The category of Game Reserve/protected area designation determines the type of activities and facilities that are permitted. For example, greater restrictions are placed upon activities and facilities in a wildlife nature reserve because of the higher conservation priorities. It is necessary for some infrastructure to exist within close proximity to the park, since travellers require items such as road access, accommodation and restaurants to comfortably visit the area.

2.4 Accommodations

Usually accommodations are restricted or forbidden in wildlife Game reserve/Nature Reserves, (Category II), In some cases where Game Reserves were established after the area was settled, local communities live within the park. Accommodations are typically found in the buffer, or peripheral zones, of Game Reserves. Such developments are best located outside the park because of the strong emphasis on protection and conservation within the Reserve. In many regions of East Asia local people reside inside and along borders of protected areas. Potentially, some local people can offer small-scale accommodations to travellers and gain income. This is an example of how tourism spending directly benefits the local people, and circulates within the local economy. In this way, leakage of tourism spending to outside parties is reduced. Large-scale accommodation developments are usually better situated away from these zones since their looming presence may be inappropriate in this context

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It is important to gain the support of the local communities and of local accommodation providers if the conservation goals of the Game Reserve area are to be achieved. Two ways of gaining support from local communities include involving them in the management of the Reserve, and ensuring that the local people benefit directly from tourism activities associated with the area.

2.5 Building Park Infrastructure

Long-term planning decisions must be made regarding limits of acceptable use, facility design, energy use, transportation, waste disposal, and available resources when designing tourism facilities and services in protected areas DN Cole proposed a minimum area not over 1.00% and a maximum of 5% Stankey et al (2009) These types of decisions will impact the overall, long-term tourism development of a site. For example, deciding upon limits of acceptable use will determine the types and amounts of infrastructure that is required within the park. This infrastructure will be in place for years to come. Decisions such as these are often very complex, and it is good to seek opinions and assistance from a broad range of other people during the decision making process. Principally, a technical basis for the decision is required as attempted in this work using the LAC Model

2.6 Zoning for infrastructure development

Zoning is an essential part of all wildlife Game Reserve management plans. Its main purposes are to define and map the different levels of protection and use that will occur in the Game Reserve and to separate potentially conflicting human activities. Zoning must be comprehensive, but also as simple as possible. This ensures that it can be readily understood by the public and be translated into management actions and regulations that are easy to comply with and enforce. To

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avoid unnecessary regulation of human activities, each zone should have clear and justifiable objectives (Parks Canada, 1994).

Examples of zoning designations include

a. Areas of strict protection, e.g. areas dedicated to wildlife and biodiversity growth and regeneration
b. Low level use Areas e.g. allowing scientific study or non-motorized travel in small groups
c. Intensive use Areas e.g. allowing visitor facilities such as washrooms, reception, parking lots and education centres, etc. and
d. Park operations Areas e.g. allowing administrative offices, maintenance sheds waste disposal facilities, etc.

If additions to Game Reserve infrastructure are necessary, location of such infrastructure outside the Game Reserve are be considered (Park Canada, 2002), Zoning determines the location of appropriate tourism development, including the construction of buildings and other facilities related to visitor management and park operations. When adding to park infrastructure, the following should be considered:

a. Construct the minimum necessary, Area between one percent (1%) and a maximum of five (5%) percent
b. Construct to aid visitor management (e.g., location and size of car parks)
c. Structures should interfere as little as possible with the natural ecosystem
d. Structures should not dominate their natural surroundings and should, where possible, reflect local traditions and local materials

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e. Environmentally friendly design should be applied to building design, construction and functioning.

f. Consider waste minimisation and collection systems – energy saving should be encouraged, using renewable resources where possible, recycling waste water, and using natural filtration systems for sewage waste disposal

g. Accommodation should be modest, comfortable and unpretentious.

(The Royal Society for the Conservation of Nature, 1998)

Zoning practices should also extend beyond the boundaries of the protected area when possible and when necessary. For example, where visitor demand is high, more resilient areas outside the park boundaries can be developed to accommodate overspill, with alternative trail systems, picnic sites and information points. Private sector may be involved in some of these operations.

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Table 2: Gezt (1987) when assessing the capacity of Spey Valley Game Reserve, formulated the following response to sustainability factors

PHYSICAL	ECONOMIC	Environmental	PERCEPTUAL
• Accessibility • Accommodation • Transportation • Space/Land • Infrastructure • Attraction	• Capital investment • Running cost • Opportunity costs • Effects on other sectors • Labour supply/skills • Inflation • Supply and demand	• Changes in natural processes Risk of fire, litter, pollution, erosion • Viability of wildlife and vegetation compromise	• Scenery • User preferences and motivations • Activities
• Physical limits of land supply Area exceeding 1%>A>5% • Dangerous crowding	• infrastructure sited in neighbouring settlement • .Employment generated in neighbouring villages	• Uniqueness lost or threatened Disaster expected • Changes irrevocable	• User dissatisfaction • Failure to attract tourists • Major change in landscape quality
• Physical limits can be altered Supply can be substituted	• Economy fluctuates • Markets can be created/changed • Competition prevents some choice • Difficulty to forecast viability	• Management can alter effects and processes • What are acceptable changes? • Difficult to predict impacts	• Management can reduce problems • User perceptions differ • Different user-groups can be attracted to area

Source: DNCole (1989)

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2.7 GENERAL APPROACHES TO ASSESSING CARRYING CAPACITY

2.7.1 Define the carrying capacity that needs to be established for the study area:

Tourism carrying capacity

Recreation carrying capacity

others, infrastructure provision/Basecamp

Consider the above from one or more of the following perspectives:

Physical carrying capacity

social carrying capacity

economic carrying capacity

Consider factors that affect the overall capacity of an area:

Options: access capacity

commercial capacity

construction capacity

service capacity

transport capacity

Others

2.7.2 Consider the type of tourism existing or being planned from the following contexts:

Physical, social, cultural, infrastructure, economic benefits, tourism image, indigenous environment others, In the case of Yankari Game Reserve, the type of tourism being planned is infrastructure development

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2.7.3 Objectives of the area:

Conservation of natural resources, preservation of areas of unique scientific, historical and cultural value, preservation of heritage, tourism and recreation, employment opportunities.

Physical and economic consequences of use should be consistent with area management objectives. If an area has more than one objective, then state the objective of highest priority. Conservation objectives followed by recreation objectives

In the Spey Valley example, Getz (1981), the key indicators of impact were assessed by reference to the objectives of tourist development boards, and subsequently derived quantifiable and subjective criteria (Table 4). This is useful for monitoring the impacts of tourism on an area**.**

Table 3: Criteria FOR ASSESSING IMPACT of INFRASTRUCTURE PLANNING AND DEVELOPMENT IN SPEY VALLEY Game Reserve

Protected Area	QUANTIFIABLE CRITERIA	SUBJECTIVE CRITERIA
Population stabilised (or growth encouraged)	➢ size of infrastructure put in place	➢ Base Camp b/w 1% & 5% of land area ➢ expectations/motivations of in-coming visitors ➢ choice of location
Opportunities for employment increased	➢ new jobs created in tourism ➢ indirect generation of jobs ➢ reduce	➢ jobs to benefit special needs opportunity for choice opportunity for advancement ➢ satisfaction with jobs
Incomes increased	➢ raise personal andhousehold incomes minimise inflation ➢ raise local authority income	□ risks of dependency on tourism □ who benefits most?
Viability of protected area enhanced and efficient use made of tourism	➢ infrastructure, services and facilities made adequate supply of land made adequate	➢ attitudes toward change to environment ➢ leadership (availability and quality) ➢ satisfaction with conditions, and tourism environments

Source: DN Cole

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2.8 Established criteria that affect capacity size

The established criteria that affect capacity size of a Game Reserve include

Physical element

a. Area size

b. Accessible space

c. Visual impact

d. Climate

e. Aesthetics

f. Availability of facilities

g. Accommodation quality

h. Number of people that can be accommodated

Environmental element

a. The need for conservation

b. Fragility of the environment

c. Wildlife resources

d. Vegetation cover

e. Behavioural sensitivity of species/wildlife

f. Impact of use on the area

g. Resiliency of ecosystems/ species

h. Others

Social elements

a. Perceptual and behavioural responses

b. Visitor expectations and preferences

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c. Visitors attitude and behaviour

d. Response to rising use level

e. Acceptable level of crowding

f. Visitor activity

g. Visitor satisfaction

h. Visitor opinions

Economic

a. Investments level

b. Volume of tourist

c. Level of economic benefits provided

d. Cost of the holiday

Infrastructure

a. Availability of utilities

b. Transport facility

c. Availability of water supply

d. Proper disposal of solid and liquid waste

Administrative

a. Level at which management policy is implemented

b. Legal restraints

c. Policy incentives

Adopted from Cole (1989)

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2.9 Criteria for Assessing the Carrying Capacity of the Area:

(a) Physical carrying capacity

(i) Consider in terms of time and space variables, and tourist function rates.

Time:

a. .peak capacity
b. daily capacity
c. weekly capacity
d. yearly capacity
e. seasonal and diurnal
f. others

Space:

a. space coefficients
b. unit measures
c. density zones
d. equipment ratios
e. others

Tourist function rates:

i. ratios
ii. others

Threshold capacities:

iii. economic viability
iv. water resources
v. others

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(ii) Apply Boullon's (1985) formula.

$$\text{Carrying capacity} = \frac{\text{Area used by tourist}}{\text{Average Individual standard}}$$

The total number of allowed daily visits is then obtained:

- Total daily visits = Carrying capacity x Rotation coefficient

The rotation coefficient is thus determined:

(iii)Acceptable /desirable limits, =

Cole (1989) proposed that Acceptable /desirable limits maybe computed as follows

$$\text{Percentage of BCA} = \frac{\text{Developed Area}}{\text{Total land Area}} \times 100\% \text{ (Cole, 1987)}$$

2.10 MANAGEMENT AND IMPLEMENTATION GUIDELINES

1. Consider the stage of the tourism life cycle that the area is in, and manage accordingly:

Options:

a. exploration stage

b. growth/development stage

c. mature/consolidation stage

d. decline stage

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(i) **Zone the area according to its use and objectives, and develop specific management plans for each zone:**

Options: Conservation, Recreation, Space for development

(ii) **If in line with Management Objectives, Consider ways to increase the carrying capacity of the area:**

Options: establish quotas which set numerical limits on visitors,

reduce conflict between competing uses

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CHAPTER THREE

Research Methodology

This section covers the conceptual framework of the study, data required and data collection, sampling techniques used for tourists and non-tourists survey as well as data analysis and presentation

The main issue of discussion in this research consist of generating argument on balancing between infrastructure provision, conservation of the natural environment and provision of quality visitor experience and finding the limits for environmentally sustainable change/use for infrastructure provision in Yankari Game Reserve.

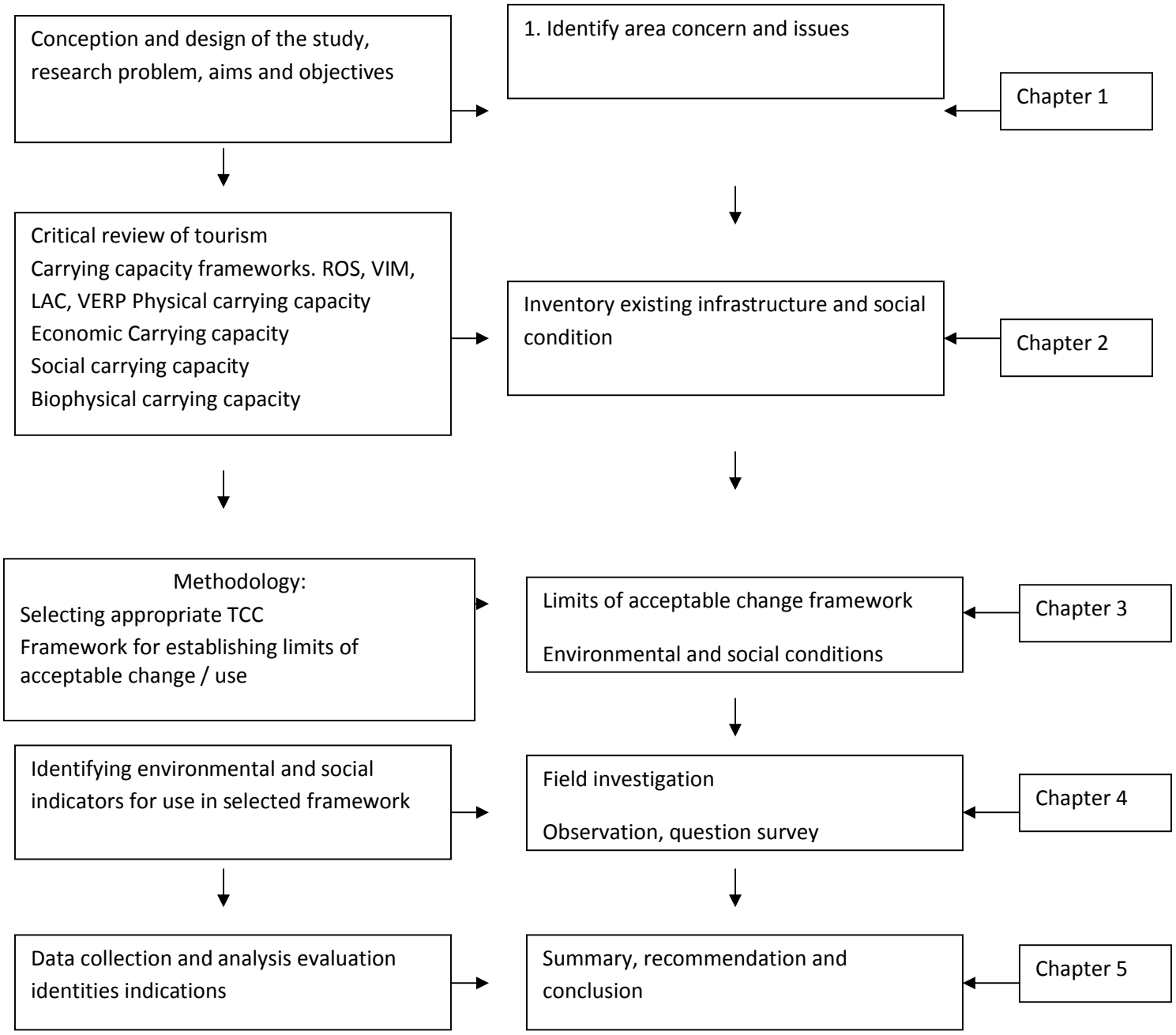
The factors which influence Environmental carrying capacity of Yankari Game Reserve

1. Tourist population and characteristics
2. Availability of land
3. Social condition
4. Transportation and communication
5. Resilience of flora and fauna to tourist disturbance
6. Infrastructure including parking space, accommodation,

The study involves field survey of existing status of infrastructure in the Game Reserve, Tourist and non-tourist population within and outside the Game Reserve, in addition to secondary data from the Bauchi State Tourism Board, record of tourist visit for a period of five year

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CONCEPTUAL FRAMEWORK OF THE STUDY



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3.2 Methods of Data Collection

The data from primary sources were obtained using the following methods:

Reconnaissance survey:-this was carried out to determine the extent of the existing environmental and physical development conditions through appraising the statues of infrastructures and their capacity to absorbed volume of tourist visitation per day, week, per month and per annum and to delineate the Game Reserve for easy administration of questionnaires

3.2.1 Questionnaire surveys: - the survey were used to ask tourist and non tourist as users of the Game Reserve their perceptions of increased infrastructure development. Three sets of questionnaires were administered in the study area, questionnaire A was administered to management and staff of the Game Reserve, questionnaire 'B' was an opinion survey of tourist perceptions/ expectation of the Game Reserve whether they are met or not, questionnaire 'C' was an opinion survey of stakeholders including host communities/villages within the Game Reserve boundary

3.2.2 Informal interview: this was conducted with officials handling infrastructure expansion, staff and stakeholders, and visitors

3.2.3 Secondary data sources: though review of relevant literature, magazines, and official records. Available literature on subject matter was utilise in addition to document obtain from National Park Services, Ministry of Tourism Bauchi,

3.2.4 Review of maps: - Some relevant maps were used to analysed and photographs of developed spaces

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3.2.5 Review of Strategic Environmental Assessment (SEA) and land use planning for Yankari Game Reserve

Strategic environmental assessment refers to the environmental assessment (EA) of policies, plans, and programmes (PPP).the concept of SEA has evolved from the well established practice of environmental impact assessment (EIA), which has been widely accepted as a means of improving the quality of decisions about proposed projects. SEA has develop, in part as a consequence of the emerging awareness that project EIA may occur too late in the planning process to ensure that all the alternatives and impacts relevant to sustainable development goals are adequately considered(lee and Walsh,1992) in Carys Jones(2010,p6)

The SEA of land use plans is intended to is intended to help predict potential environmental impacts that could occur as a result of their implementations, as part of the wider promotion of the planning system as a tool to help deliver sustainable devevlopment

3.2.6 Questionnaires on Visitors/Tourist perception of environmental condition of the Reserve

An eco-tourist is defined as someone who engages in responsible travel to natural areas, which conserve the environment and sustain the livelihood of local people. Tourist to Yankari Game Reserve consist of males and female, adult and youth, since the focus of the sustainable development of infrastructure in the Game Reserve

One questionnaire was administered to the tourist which ask their perception on infrastructure and environmental condition

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Table 4: Structure of tourist and Non tourist survey

Subject	Questionnaire 1Tourist	Questionnaire 2Non-Tourist
Tourist characteristics and socio-economic	Age,sex,marital status,education,number in group, occupation, income	Age,sex, marital status,education,number in group, occupation, income
environmental and social conditions in the camp site	perceptions, motivations and tourist experience	perceptions, of environmental and social conditions
opinions and suggestions on environmental and social conditions	present condition of infrastructure development taking environmental sustainability into considerations suggestions for improvement	present condition of infrastructure development taking environmental sustainability into considerations suggestions for improvement

Source: Field Survey

Table 5: Structure of the Sampling Design

Area	First stage (camp-site)	second stage Administrators of the game reserve	third stage(stakeholders and business operators
Yankari Game Reserve	tourist day visitors, overnight visitors,	management and staff	Ministry and tourism development agency

Source:field survey

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Satelite imagery of Yankari Game Reserve Basecamp at Wikki
Source Google Earth

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CHAPTER FOUR

4.0 Status of Tourism infrastructure in yankari Game Reserve

4.1 Access Road

The distance between the main entrance gate and the Wikki camp is about 42km. The road is presently graded and tarred with 7.3 metre width, the enhanced access is likely however to increase potentials for road hazards'/impacts such as road kills, Roundabouts at identified animal crossing routes have been built, there are also restriction in the form of bends/speed bumps, also installed along the road are speed trapping devices which ensure that transgressors are penalised and further encourage adherence to the speed limits



plate 1: **Baboon running on Access Road**

The implication is that tourist passing this access road are liable to attack by wildlife, also road kills of small and large animals is likely to increase with length of the road deep into the Game Reserve

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Plate 2: Base Camp infrastructure

According to Cole (1987) such elaborate facility are to be sited outside the protected area in neighbouring villages.This will bring economic benefits to the villages and in turn improve environmental sustainability of the Game Reserve

4.2 The WIKKI Camp Infrastructure

Existing facilities to complement tourism resource at the Wikki camp, the only camp within the centre of Yankari Game Reserve approxin

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77hectares of land and has the largest concentration of infrastructure. Facilities presently available include 110 chalets in various categories, low-budget hotels, a restaurant, a conference hall, with capacity for 100 people, a sourvenir shop and a clinic. Also at the centre of the camp is a block of building housing a museum a small reception area, a conference room and an administrative building There is a garden plaza with footpath leading to the Wikki warm spring. To the west of this block are the presidential lodge and 2 model suites. Other facilities/infrastructure dotted around the park include several clusters of chalets, staff quarter , a mosque, a chapel, a tennis court, access road and a petrol station.

Table 6: TYPES OF ACCOMMODAQTION AT THE WIKKI CAMP

Type of Accommodation	**No/Qty**	**Suites Capacity**
Presidential Lodge	24 (Number)	Enough to contain a family of ten(10)
VIP Suites	11	each suites has a bed room/sitting room and toilets
Luxury suites	36	2bedrooms each and a toilet
Royal Villa	36	Executive statues and BQ
Corporate Villa	4	executive statues
Single rooms	48	Single
Studio suites	12	bed room/sitting room and a toilet
Studio	12	2 rooms each/sitting room and a toilet

Source: field survey/master plan

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4.3 The proposed facility /infrastructure up-grading at the Wikki-camp is to be executed in two (2) phases

Proposed infrastructure up-Grading

a. Four or five star Hotel

ii. 18 or 19 Golf course

iii. Airstrip

iv. Theme park

Phase 1

Components of phase one facilities

. Access and Reception

. Wikki Safari and Research Centre

. Accommodations (Hotels and Related facilities

. Nature Village (Day activity)

. Eagles Sports and Recreation centre

. Amenities (Resort Back and Support Centre

. Infrastructure and Support Centre

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4. 4 Accommodation and Related facilities

The proposed Yankari Game Reserve accommodation facilities comprises of the following

- Single rooms (48 number)
- Deluxe rooms(24 number)
- Luxury suites (36,2-bedrooms)
- Royal villa
- Corporate villa
- Other supporting accommodation facilities include coffee bar, restaurant, terrace, room service, executive boardrooms, pool facilities, rest rooms gift shop, swimming pool, Boma facilities,

The Yankari Retreat Luxury Suites will offer four ‘’4’’ to five ‘’5’’ star hotel accommodations targeted to the high-income Nigerian market. The architectural design of the facility will incorporate the Rhythm of the African theme by using colours and designs that are common to the Bauchi region. The Retreat will be located separately from the main public areas

The retreat is designed to be located separately from the main areas in a more secluded part of the WIKKI Camp. The area is proposed to be surrounded with wild gardens and natural paths leading the visitor to his accommodation, it also has a public area and accommodation suites position in order to maximise views of the natural environment through large bay windows

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Plate3: Lodging facility

4.5 Royal Villa

Thirty-six (36) room luxury suites are proposed to be developed at the Retreat. The configuration will be a traditional cluster style of development with all suites built around a central courtyard. The suites will be access via the central courtyard which will be landscaped and providing a meeting point for guest such as gazebo, wooden benches, natural fountain etc.

The suites will comprise two bedroom units with facilities comprising of the following minimum sizes

- Master bedroom-24.5m^2
- Master bathroom-6.25m^2
- Guest bedroom---24.5m^2

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- Lounge and dining area—28m^2
- Viewing deck---------21m^2

4.6 Deluxe suites

These suites will be limited service three-star facility targeted to the middle-income Nigerian market located adjacent to the Retreat Luxury suites; however the two will be separated by natural vegetation and access between the two provided by walking and cart paths.

The accommodation will comprise of 72 rooms of 12 blocks—4 rooms each and 12 blocks-2 rooms each, for the studio and deluxe suites respectively. The ‘’cluster effect’’, representing African traditional cultural villages in Bauchi region, will also be utilised in the design of the facility.

Each studio will comprise of a minimum of 17.4m^2 with the bathroom at least 4.7m^2. the rooms will be provided with double or twin beds dependent on the guest request.

Laundry and dry cleaning services are to be provided on a daily basis.

Storage- A storage area of approximately 12 square meters per 30 rooms

4.7 Corporate Villas

Four (4) corporate Villas specializing in the entertainment of the corporate market will be provided at the Wikki Camp. Design specifications are for the villas will be commensurate with those of the Retreat and Spring Studio Suites which strongly reflect traditional design techniques

The corporate villas will comprise of six (6) en-suite bedrooms each with rooms having a minimum area of 24.5m^2in size and the bath rooms 6.75m^2

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A patio area large enough for two sun lounges with table and chairs will be provided. The rooms will offer comfort and luxury



Plate 4: Road network in the Base camp

4.8 The presidential Villa

The presidential villa offer quality accommodation facilities that can cater for the needs of visitors from the very higher class, also complementary facilities on a vacant land adjacent to the entrance gate to the presidential villa will be provided. Ten quality accommodation facilities will be provided that can cater to the needs of the

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and presidential entourage. Such facilities will be flexible in order to enable the conversion of certain areas into secretariat area for the Governor or president if required. Ten (10) bedrooms 17.4m^2 with bathroom at least the size of 4.7m^2 will be provided.

4.9 Conference facilities

The conference facility has capacity for 100 persons at a time. it include the creation of ‘’Nature ‘’village the Hub of the resort development it include a bar, a night club, play pen, retail outlets, Boutique and a snack shop

TABLE: 7 MANAGEMENT/SUPPORTING FACILITIES

Administrative buildings	Location
5no block of buildings	wiki camp
Staff quarters	Outside camp base
Students hostels	base camp
filling station (Mobil)	Outside wikki
prayer facilities	Wikki Camp
Research school (Affolori)	Wikki camp
Restaurant and Amenity centre	Wikki camp
Work shop	WIKKI camp
Security equipment	Wikki camp
Game viewing Vehicles (10no)	Wikki camp

Source: Field Investigation

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Table 8 Annual Tourist In-Flow 2001-2008

YEAR	NIGERIAN	BRISTISH	AMERICANS	CHINESE	W/A
2001	13,372	308	301	79	1308
2002	9632	372	305	64	1008
2003	8632	301	316	12	1076
2004	13,372	332	452	08	886
2005	20,211	249	256	24	993
2006	31,851	302	336	36	1572
2007	34,297	379	379	47	1487
2008	36,896	383	308	56	1218

Source: Yankari Game Reserve

The table 8 shows annual tourist inflow into Yankari Game Reserve 2003 recorded the least turnover of Nigerian tourist with 8632 while 2008 recorded the highest number of Nigerian visitors with 36,896 visitors.

The majority of tourists interviewed are more concerned with experiencing wildlife and wilderness environment than infrastructures and buildings. An American openly commented that these “Guys” want to drive the wildlife and kill the natural environment by putting up structures everywhere

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CHAPTER FIVE

5.0 TOURIST AND NON-TOURIST IMPRESSIONS OF THE BASECAMP AND THE GAME RESERVE ENVIRONMENT

This section presents the result of analysis of the data collected and the perception of tourist and non tourist of infrastructure development in a natural environment such as a Game Reserve, as stated in the methodology Statistical Package for Social Sciences (SPSS, 2000) was used to analyse the data.

A number of variables are used for which comparison of simple percentages about the perceptions of tourists and non-tourists of the past, present and future conditions in the study area are obtained.

Table: 9 Tourist impressions of the basecamp

Indicator/parameter	Frequency	Percentage
camp area rating	87	37.35
development rating	6	32.18
trash ratings	54	11.04
tree damage ratings	60	10.49
camp trails	19	09.91
Total	174	100%

Source: field survey

The table 9 shows response obtained from tourist and non-tourist indicators and parameters that are consider important in determining the minimum amount of impression /change based on observation that can be considered a real c

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representing 37% of the respondent were of the opinion the existing camp area is more than adequate for hosting tourist needs, while 56 representing 32.18% of the respondent said that the existing development are adequate to cater for the needs of tourist,



Plate:5 A wild Animal (rare) around the camp

5.1 Current quality of the natural environment

The survey instruments were used to ask tourists and "non-tourists" (safari personnel, camp managers and staff, government officials, scientists) to rate their impressions of the current quality of the natural environment (e.g., amount and diversity of bird life and animal life, condition of the vegetation) and the current situation of a number of environmental variables (e.g. tourism infrastructure, number and types of accommodation facilities they are expecting at the Yankari game reserve) using a 5-point Likert scale ranging from excellent to poor for environmental quality and "amount exceeds reasonable Limits to "amount could be substantially

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increased" for situational variables. Respondents were also asked to rate the same variables assuming double the number of tourists by the year 2012. Items in the questionnaire were derived both from the literature (e.g., Brougham and Butler, 1981; Husbands, 1989; Milman and Pizam, 1988; Ahn *et al.*, 2002) and from comments and critiques of supervisors, course mates, and tourism staff and managers. Tourists were also asked to rate the quality of their experience in the Game Reserve and provide a minimum of demographic background.

Table:10 Tourist experience

Variables	**freq**	**5**	**4**	**3**	**2**	**1**
Solitude and Tranquillity	87	✓				
Quality of Birdlife and Wildlife Viewing	91	✓				
Waste management	60		✓			
Quality of Natural environment	40				✓	
Absence of human generated noise	70		✓			
Quality of trails for viewing animals	67		✓			
Total	487					

Source: field survey

Ratings based on a 5point Likerts Scale 5=highly satisfied, 4=satisfied, 3= good, 2=fair, 1= need improvement

Result from six variables designed to measure the experience of tourists at Yankari Game Reserve are shown in Table 10. Overall, t

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Reserves solitude and tranquillity, quality of wildlife and bird life, quality of the natural environment, and the absence of human generated noise. Our sample of guests seems to have gotten what they paid for in most respects---the experience of a pristine environment.

5.2 Tourist Perception of Infrastructure at the Game Reserve

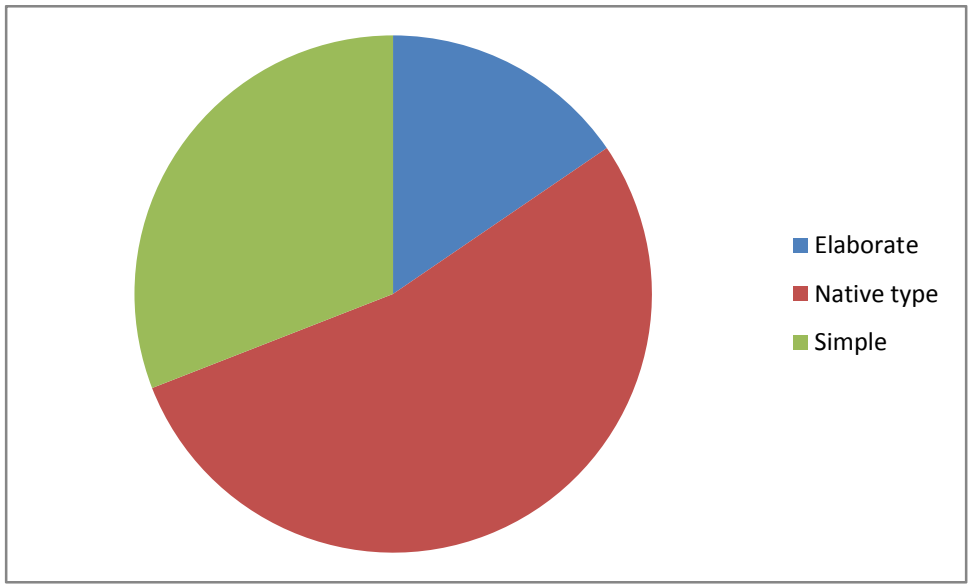


Fig. 1 Source: Field Survey Analysis 2009

Tourists were ask to rate their perception of infrastructure provision in the Game Reserve, the result shows that about 64% of our respondent were expecting accommodation to be local design and building materials used, while 20% indicated their perception to be simple type, about 16% of the respondent thought accommodation should be elaborate and modern design, The response suggest that tourists are expecting native or simple type of accommodation rather than the elaborate type.

In response to the question whether more accommodation facilities should be constructed within the game reserve, tourist gave the following response

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Chart 3: opinions on more Accommodations

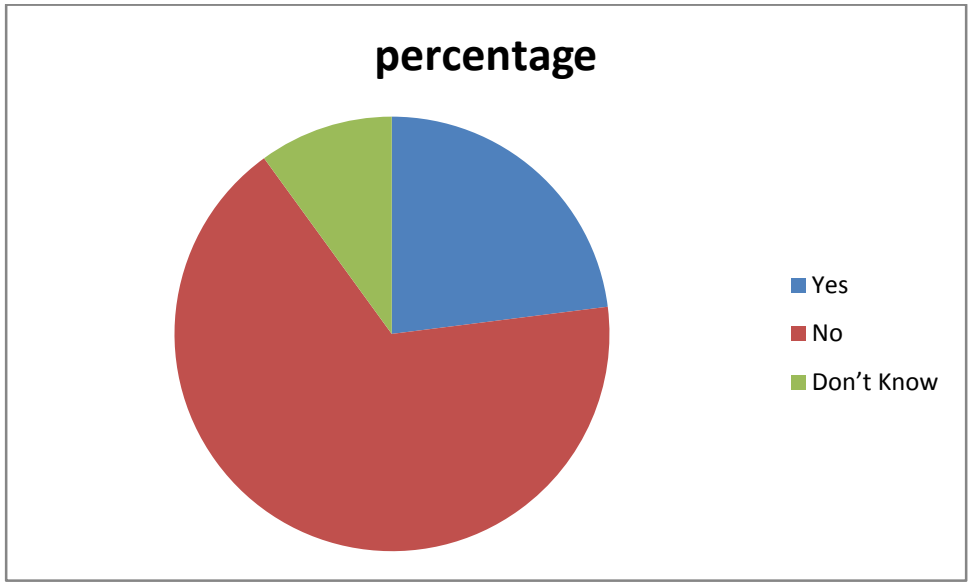


Fig. 2 Source: field survey

About 67%% of the respondents are of the view that there is no need for the construction of more facilities within the Game Reserve, while 23% are of the opinion there should be more facilities in the Reserve and about 10% of the respondents are undecided.

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Percentage of visitors and non-visitors ratings of acceptability of impact of infrastructure development

	Visitor Ratings				Non-visitor Ratings		
				X			
				Significance			
Base Camp Impact	D	A	U		D	A	U
Solitude & Tranquillity							
Severe	21	33	46		32	64	04
Heavy	35	54	10		72	05	23
Moderate	41	53	05		34	39	27
Minimal	48	49	03		49	23	28
Tree damage							
Severe	10	30	60		05	39	56
Heavy	2	51	20		08	50	42
Moderate	68	2	05		08	01	91
Minimal	71	25	04		05	01	94
Bare ground							
Severe	07	14	79		02	15	83
Heavy	07	36	57		01	32	67
Moderate	09	43	48		04	34	62
Minimal	04	20	61		24	71	05
Pristine	73	23	04				

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D=desirable, A= acceptable, but not desirable = unacceptable.

Source: field survey

Apparently visitors find the provision of more infrastructure objectionable compared with non visitors, Most of the respondent were of the opinion that more buildings will not be compatible with pristine environment, larger percentage of the respondent viewed the consequence of infrastructure development on the solitude and tranquillity of the natural environment as severe to minimal impact as being unacceptable while others viewed it as acceptable but not desirable

Visitors and non visitors show different evaluative standards of acceptability for base camp impact, Non-visitors have stricter standards of impact for tree damage and Bare ground impact, and development.

5.4 Overall Impressions of Yankari Game Reserve

5.4.1 Non—Tourist Impressions

The non-tourists are resident workers and so very familiar with the Yankari Game Reserve. Their impressions of the quality of the environment are shown in Table3. Except for irregular electricity supply, all other variables were viewed as either good o need improvement. The percentage impression of waste management at the Wikki camp base tends toward 'fair' while the ability of animals to function naturally is perceived as good to excellent.

Tourist also tend to share the same opinions as the non tourist, whereas the percentage opinions on solitude and tranquillity, quality of birdlife and wildlife tends towards excellent and goods

In the context of the LAC framework, these non-tourists (who know the Game Reserve) seem to be cautiously raising a red flag by saying environmental quality is threatened under current levels

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of usage, but also mindful to keep their jobs by avoiding to be identified as being negative or critical of the Game Reserve.

5.5 Respondents opinion on sustainability parameters

In the Game reserve, guides, camp managers and staff, and front office management all perceive present levels of tourism to be incapable of absorbing more activity without creating unacceptable social and environmental impacts Table 5. This includes the number of safari and other vehicles tracks and roads, number of tourists, structures, and the amount of noise generated. Much to its credit, the management of the Game Reserve prohibits off-track and off-road driving and uses a small number of vehicles and personnel.

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CHAPTER SIX

6.0 TEST OF LIMITS TO ACCEPTABLE CHANGE (LAC).

The limits of Acceptable change model were applied in the Yankari Game Reserve with the following result:

Existing Development Status:

Yankari Game Reserve is first and foremost a protected area/Wildlife Game Reserve whose main objective is conservation of flora and fauna thereby maintaining nature for promotion of geographical and biodiversity. The complementary objective is the provision of Tourism and Recreation. It is therefore a tourist destination where the diversity and arrangement of land use should be design to enhance quality of Game viewing experience and the long time sustainability of the Game Reserve. The land use must therefore complement each other aesthetically, socially, economically and environmentally

Existing Area

Base camp Area ` 77hectares

Total area of land YGR $2244km^2$

100 hectares $= 1km^2$

77 hectares $= 0.77km^2$

Percentage of Area occupy by Base camp = $\frac{0.77 \times 100\%}{2244}$

$\frac{42km^2 \times 100\%}{}$

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Road infrastructure= $2244km^2$

= 1.87%

Total = 0.03+1.87=1.47%

6.1 Proposed facility upgrading

i. 18 or 19 hole golf course

ii. Theme park(mini Disney land)

iii. Air strip

iv. 4" or 5" star Hotel

The capacity size when the proposed expansion plan of the Game Reserve is implemented is considered in this sub-section

Golf Course

According to Lymann 2004, and the Golf course superintendent Association of America 2004, A standard golf course may take up to 1700—1900 acres of land.

Calculations

If we take 1900 acres as the land to be develop for golf course

$1km^2$ = 247.11 acres

$$\frac{190}{247.11}$$

$= 0.769Km^2$

Percentage of the land area required for course

$$\frac{769 \times 100\%}{2244}$$

= 0.34%

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ii. Theme Park or Amusement park

A theme park is an amusement park with a focus on one or more ideas. Rides and attractions are grouped according to theme. Some famous theme parks are centred on Animals, while others are inspired by folklore or history. All require sizable areas of land and offerings that will entice visitors over a wide area and it may occupy a land area between 250 to 300 acres of (WTO, 2010)

Calculations,

If we take 300 acres as the land area required for a standard theme park

$1km^2 = 247.11$ acres

$$\frac{300}{247.11}$$

$$= 1.22Km^2$$

Percentage of land Area to be taken by Theme park will be

$$\frac{1.22 \times 100\%}{2244} = 0.054\%$$

6.2 Airstrip

The first step in constructing an airstrip is to determine where to locate it. Chances are that your choice of a site for the airstrip is limited to one or two of the more suitable areas on the protected/Game Reserve. It may often be possible to select a suitable ridge or plateau which although more removed from such buildings, would still provide the desired convenience, especially if it were possible to taxi the airplane up to the dwellings. Certainly, access to a road or highway would increase the usefulness and convenience of the airstrip. The terrain in the selected area obviously must be sufficiently

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layout of the landing strip and perhaps a small building area without too much grading and other construction. The land selected should have natural drainage to insure freedom from standing water or muddy soft spots. Gentle slopes are permissible.

Length: (target) 1200m

Strip Width: 60m (90m for night ops) cleared total, 18m runway

Runway: central 18m

> Free of anthills, holes, cattle tracks, ruts

> Firm surface

> When wet, a four tonne truck should not leave more than a half inch impression on the runway

> No vegetation

Rick Perry et al (2004)

Calculations

Total area require for a standard air strip

1200x60 =72000m^2

10000m^2 = 1km^2

$$\frac{72000}{10000} = 7.2km^2$$

Percentage Area to be taken by the proposed airstrip

$$\frac{7.2X100\%}{2244} = 0.321\%$$

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6.2.1 Road from Airstrip to Basecamp

Length: 10km^2

Percentage of land space: $\frac{7.3X100\%}{2244}$ =0.45%

6.2.2 Standards of Hotel Classification

The star classification system is a common one for rating hotels Higher, star ratings indicate more luxury**,**Food services, entertainment, view, room variations such as size and additional amenities, spas and fitness centers, ease of access and location may be considered in establishing a standard star hotel.

Some countries have rating by a single public standard - Belgium, Denmark, Greece, Italy, Malta, Netherlands, Portugal, Spain and Hungary have laws defining the hotel rating. In Germany, Austria and Switzerland the rating is defined by the respective hotel industry association using a five-star system - the German classifications are Tourist (*), Standard (**), Comfort (***), First Class (****) and Luxury (*****) with the mark Superior to flag extras beyond the minimum defined in the standard. 4 to 5 star hotel may general occupy an area of about 365acres or 1.5km^2

Calculations

$\frac{1.5X100\%}{2244}$ = 0.067%

Total = 0.34+0.054+0.321 +0.450+ 0.067= 1.329%

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Table: 11 Existing Infrastructure

Infrastructure	Area in Km^2	% of land area taken by development
Basecamp	0.77	0.03
Road	42	1.87
Total		1.90

Table: 12 Propose Infrastructure development

Infrastructure	Area Km^2	% of land to be taken by development
Golf Course	0.77	0.340
Themepark	1.22	0.054
Airstrip	7.20	0.321
Road from Airsrip to Base camp	10	0.450
"4" to "5" statue Hotel	1.5	0.067
Total		1.329%

Percentage of Total Land area to be taken for infrastructure development = Existing + proposed

1.90 +1.33 =3.23%

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6.3 Environmental concern for infrastructure development in an essentially natural environment

Indeed, hotels, airstrip, themepark and Golf course interact with the environment at every stage of their life cycle, and this influence is often negative. Hotels are designed to provide multi-facetted comfort and services to guests, frequently accustomed to and willing to pay for exclusive amenities, treatment and entertainment. Many of the services offered by 4 star Hotel establishments require the consumption of substantial quantities of energy, water and non-durable product, while Airstrip are made for the landing and take-up of Light aircrafts, Golf courses and Theme park are recreation and sporting facilities the resulting environmental impacts arising from their operation are, typically greater in an essentially natural environment.

This section discusses the possible environmental impacts arising from the, construction, and operation of these facilities

6.3.1 Construction stage

The impacts associated with the construction stage are significant, but to a large extent, short-term. The long-term, practically irreversible impacts include the change of local landscape resulting from compulsory, excavations and grading operations. These operations may lead to a possible disturbance, and even the loss of previously unidentified sensitive on-site sub-surface cultural and historic resources, as well as sensitive and unique ecosystems.

Generally, any construction of a new hotel facility requires the removal of existing vegetation, the temporary loss of an ecosystem and habitats of local animals is almost inevitable. Despite

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frequent attempts at restoring the ecosystem after project completion, native and often sensitive flora and fauna species may be irreversibly lost.

Among the short-term impacts associated with the construction phase increased are heavy-vehicle traffic, as well as related emissions and noise are virtually unavoidable. Among the air pollutants emitted during the construction stage, dust and other particulate matter is of major significance. Furthermore, various volatile organic compounds and hydrocarbons may be emitted from materials, paints and solvents used and improperly stored.

Increased traffic and noise levels combined with impaired air quality and possible vibrations have a significantly adverse effect on the wildlife population, fauna and flora.

Table: 13 Possible impacts arising from construction work

Action	Impacts
Land excavation and grading	➢ Destruction of vegetation and landscape. ➢ Loss of biodiversity. ➢ Disturbance to and possible loss of cultural and historic resources. ➢ Air pollution (dust and vehicle emissions). ➢ Soil, surface and ground water pollution in case of accidental damage of pipes and tank
Construction	➢ Ground compaction, building sinking, and induced seismicity. ➢ Erosion, landslides and flooding.
Vehicle traffic and heavy equipment operation.	➢ Excessive use of resources (energy) and associated emissions (impaired air quality). ➢ Increased noise levels.

Source: field survey

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6.3.2 Operation stage of a ‘’4’’ star Hotel

The operation of a hotel is the most resource intensive stage of the entire life-cycle. It results from very specific operational patterns, a 24-hour-a-day, year-round, catering to large numbers of customers having highly diversified needs and attitudes. Hotels utilize large quantities of energy, water and various consumable materials in providing services and comfort to their guests. Furthermore, the efficiency of many end-users in a hotel is low, resulting in a relatively large impact, as compared to other types of similar size buildings. It is estimated that 75% of all impacts exerted by hotel facilities on the environment are associated with the extensive use of resources (APAT 2002, pp.28). This has resulted in increased pressure on resource and It also contributes to the depletion of resources.

Hotels generate large quantities of waste and sewage, thus increasing pressure on local sewer systems and plants, as well as landfills. They are also responsible for the release of various air pollutants, either directly from on-site heat and power generation, or indirectly by the use of electricity and heat/cold produced at power plants, thereby contributing to the deterioration of local air quality, acid rain and global warming. Many of the goods purchased have environmental effects associated with their manufacture, transportation, use and disposal. Furthermore, a number of substances and products used at hotel facilities are exceedingly environmentally harmful.

Table 14 Possible Impacts arising from the Operation stage of the hotel

Action	Impacts’
Operation	➢ 24- hour- a- day, year- round ➢ Catering to large numbers of customers having highly diversified needs and attitudes. ➢ Generate large quantities of waste
Vehicular Traffic	➢ Increase noise, ➢ Large influx of people

Source: field survey

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6.3.3 Golf course

Environmental concerns over the use of land for golf courses have grown over Specific issues include the amount of water and chemical pesticides and fertilizers used for maintenance, as well as the destruction of natural habitat and other environmentally important areas during construction. Golf courses require an enormous amount of water every day and this can result in water scarcity. If the water comes from wells and spring such as from Wikki warm spring, over-pumping can cause saline intrusion into groundwater.

The UN estimates that golf courses use about 2.5 billion gallons/9.5 billion liters of water daily. Many golf courses in the world are irrigated with non-potable water and/or rainwater. In 1988, the US Environmental Protection Agency prohibited the use of Diazinon on golf courses and sod farms because of negative impact on bird species.

Environmentalists and other activists continue to oppose golf courses for environmental reasons, as they occasionally impede corridors for migrating animals and sanctuaries for birds and other wildlife, though courses frequently become havens for native and non-native creatures

An average golf course in a tropical country such as Thailand needs 1500kg of chemical fertilizers, pesticides and herbicides per year and uses as much water as 60,000 rural villagers. Golf course maintenance can also deplete fresh water resources.

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Table: 15 Possible environmental impacts arising from the construction and operations of a Golf-course

Action	Impacts
Construction	➢ Destruction of natural habitat ➢ Use of Chemical fertiliser and chemical pesticide harmful to Birds and wildlife ➢ Destruction of rare tree species ➢ Impede corridors for migrating animals and sanctuaries for birds ➢ Become haven for native and non-native creatures
Increased vehicular traffic	➢ Influx of players, guest and spectators

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CHAPTER SEVEN

7.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

The magnitude and complexity of tourism infrastructure development in a protected area like Yankari Game Reserve and the negative consequences it has on the environment have been analysed. Also, it was established from literature that Tourism in protected areas is associated with appreciating and observing nature, scientific Endeavour and Education. This type of tourism is associated with minimal development of infrastructure and small scale interventions in areas of normally strong control and restrictive management.

It was also established from the literature that development and pristine environment pulls apart and that for sustainable conservation of ecosystems and wildlife, development leading to high volume of human activity should not exceed 1% to 5% of the total conservation land area. It was also established that tourist accommodations have an in built potential to grow and that once established it is difficult to restrain. Furthermore, tourism development requires a range of services usually brought in by road which create secondary impact on the protected area environment. It is therefore, necessary to consider the sustainability or otherwise of providing more tourists facility within the Game Reserve. For example, unpolluted water and waste management are desired conditions set by both regulatory and institutional structures as well as by documented assumptions about tourism in Yankari Game Reserve both by government and the private sector.

Tourists see things in starker terms. Those who pay dearly for a wilderness experience seem more likely than their industry counterparts

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one respondent who said that "more intensive visitor management of the Game Reserve is required if it is to survive." tourists perceived that present levels of development approach reasonable limits for virtually all variables.

Tourists spend large sums of money daily for the "Game Reserve experience" also assumes its natural vegetation will be clean and its game areas not degraded by dense networks of roads and buildings. These are, in other words, unacceptable levels of change and impact. When more infrastructures begin to appear as "red flags" in surveys, it is time to take notice.

Of future growth, tourist and respondents all expressed caution, albeit more muted from those in the tourism sector. Tourists' perceptions about what the Yankari Game Reserve might be like in 2020 if current trends continue are worth thinking about. Every environmental and social parameter loaded in the direction of "excellent," with Wikki camp visitors perceiving that tourist's numbers, densities, traffic on roads and amounts of liquid and solid waste are the indicators pointing to emerging unsustainable change in the Game Reserve. Guests interviewed seemed to understand the vulnerability of the Game Reserve system and that increased numbers of infrastructure could be deleterious to its wildlife.

By contrast, everyone interviewed understands that tourism brings good things like more jobs, capital investment, and a vibrant tertiary economy. They also realize, especially tourists who have travelled half way round the world that more **development and a "pristine" environment** pull in opposite directions. Herein lies the challenge of sustainable tourism infrastructure development, the moving target we aim to hit, a target that will never be achieved without careful monitoring and resolute and flexible management.

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Result from the data collected and analysed show that the existing infrastructure ie campbase and road occupies 1.90% of the total land area which according to the literature reviewed DN Cole,(1989) and Gezt,(1987) sustainable campbase should be within 1% and 5% is compatible and adequate for sustainable campbase and for conservation of biodiversity

While the proposed infrastructure development will occupy 1.74% additional land area, which implies that the total percentage of land to be taken for infrastructure development will be 1.40% + 1.33%= 3.23% In the context Of the limits to acceptable change framework this value seem to be implying that more infrastructure development will cause impacts that diverge significantly from norms associated with Game Reserve objectives, in other words the Limits to Acceptable Change are being reached, Managers must either limit development or change tourist expectations.

However the following options are hereby recommended for adoption in the management of the Game Reserve;

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7.2 Policy Recommendations

To maintain the harmonious interaction of nature and development through the protection of the Game Reserve environment, the following policy recommendations are hereby made

Zoning Policy

The Game Reserve is to be zoned into four areas such as;

i. **Intensive use Area**

The present area of land occupy by the **B**aseCamp be maintained it serve as Intensive use area, i.e. Area allowing visitor facilities such as wash rooms, receptions, parking lots and visitor centres

ii. **Areas of strict protection.** Means areas that are designed specifically for nature protection and regeneration of biodiversity

iii. **Low level use Areas**. Allowing scientific study and non motorised travel in small groups and tourism and recreation

iv. Regarding the upgrading of the existing airstrip in the Game Reserve, the Airports in Bauchi State, and that of the neighbouring states of Plateau and Gombe and the FCT should serve the air transport need of the Game Reserve. Since noise generated by the landing and take up of aircraft as well as vehicle movements from the airstrip through Game Reserve is likely to distort the natural serenity of the protected area habitat

v. The management staff quarters, Engineering infrastructure yards, Students hostels/lecture rooms, and the transport and maintenance centre should be move to a location outside the game Reserv

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vi. For surveillance purpose the present method used by rangers on daily basis should be sustained

vii. The park authority should develop a policy whereby the private sector will take over the management of accommodation, restaurant, conference facility and the collection of entry fees, this in turn will free the park staff to be more dedicated to conservation and protection activities.

viii. On the other hand, a new capacity building program for improving the parks biodiversity and conservation should be instituted using the funds meant for infrastructure development

ix. Among the objectives of ecotourism is the bringing of benefits to the local community, therefore developing the 4' to 5' star hotel within the neighbouring villages would provide sustainable benefits in terms of employment and wealth creation to the local populace.

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YANKARI NATIONAL PARK: RELIEF AND ROADS



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