

Indo - African Journal for Resource Management and Planning (An International Peer Reviewed Research Journal)

ISSN 2347-1786.
VOL 2. NO. 01
September 15, 2014

Article info

Received on March 15, 2014

Published on September 15, 2014

India

Route networking of World heritage sites and major national parks based on directions and accessibility in Ethiopia

Zubairul Islam¹ Fikre Belay² Abineh Tilahun³ Shally Kapoor⁵

¹Associate Professor, Department of Geography and Env. Studies, Adigrat University, Ethiopia.
Email: zubairul@gmail.com, Mobile no: +251 - 0919999952

²Dean, College of Social Science and humanities, Adigrat University, Ethiopia.
Email: fikrebelay23@yahoo.com, Mobile no: +251 - 0914753512

³Lecturer, Department of Geography and Environmental Studies, Adigrat University, Ethiopia
(ababineh@gmail.com)

Abstract

In this paper route networking is done on the basis of Air Ports locations and roads available for movement from one place to another place. Ethiopia has a number of tourist places but for this study only twenty three tourist places are included nine those registered under UNESCO world heritage list and fifteen important National parks.

Grouping of tourist paces was done on the basis of distance, direction and accessibility. For distance average nearest neighbor distance was calculated

For each group most suitable airport was chosen based on location to start travelling. As a result five grouped were found in five directions North, South, East, West and Central. The total length of Northern circuit was measured 797.7 kilometers, Central circuit 686.78 kilometers, eastern circuit 632.32 kilometers, Western circuit 1010.27 kilometers and southern circuit has a distance of 970.58 kilometers.

Key words: Route networking, GIS, National Parks, World heritage sites.

1. INTRODUCTION

Ethiopia is widely considered the site of the emergence of anatomically modern humans, *Homo sapiens*, in the Middle Paleolithic 200,000 years ago. The earliest known modern human bones were found in Southwestern Ethiopia, and are called the Omo remains [1].

At 1,126,829 square kilometres [2] Ethiopia is the world's 27th-largest country, comparable in size to Bolivia. It lies between latitudes 3° and 15°N, and longitudes 33° and 48°E.

Ethiopia has 31 endemic species of mammals [3].

Ethiopia is a global center of avian diversity. To date more than 856 bird species have been recorded in Ethiopia, 20 of which are endemic to the country [4].

As the first part of a ten-year Road Sector Development Program, between 1997 and 2002 the Ethiopian government began a sustained effort to improve its infrastructure of roads. As a result, as of 2002 Ethiopia has a total (Federal and Regional) 33,297 km of roads, both paved and gravel [5].

Ethiopia has 58 airports as of 2012.[6] Among these, the Bole International Airport in Addis Ababa and the Aba Tenna Dejazmach Yilma International Airport in Dire Dawa accommodate international flights. Ethiopian Airlines is the country's flag carrier, and is wholly owned by the Government of Ethiopia [7]. From its hub at the Bole International Airport, the airline serves a network of 62 international destinations and 16 domestic ones [8]. It is also one of the fastest-growing carriers in the industry [9] and one of Africa's largest airlines.

Ethiopia has the most UNESCO World Heritage Sites in Africa [10] also there are seventeen National Parks. UNESCO World Heritage Sites in Ethiopia are Aksum, Fasil Ghebbi fortress, Harar Jugol, Konso, Lower Valley of the Awash, Rock-Hewn Churches, Lalibela, Simien National Park and Tiya.

The ruins of the city of Aksum, dating from the 1st to the 13th century, mark the heart of ancient Ethiopia and what was the "most powerful state between the Eastern Roman Empire and Persia". It includes monolithic obelisks, giant stelae, royal tombs, and ruins of former castles [11].

Fasil Ghebbi fortress was the residence of the Ethiopian emperors during the 16th and 17th century. The city remains, which feature buildings with Hindu and Arab influences, were later remodeled with Baroque-style architecture by Jesuit missionaries [12].

Harar Jugol the Fortified Historic Town is on a plateau and surrounded by gorges and savanna. It contains 82 mosques, 102 shrines, and unique interior design in the townhouses. It is said to be the fourth-holiest city of Islam [13].

Konso Cultural Landscape is the site features 55 kilometres of stonewalled terraces and fortified settlements in the Konso highlands of Ethiopia [14].

Lower Valley of the Awash is the Palaeontological findings from at least four million years ago, such as Lucy, give evidence of human evolution [15].

Rock-Hewn Churches, Lalibela is the site contains eleven medieval cave churches from the 13th century [16].

Simien National Park is the eroded Ethiopian plateau comprises jagged mountain peaks, deep valleys, and sharp precipices dropping about 1,500 m (4,900 ft)[17]. The decrease of the walia ibex, bushbuck, and bushpig populations, as well as an increase of the human population in the park prompted the World Heritage Committee to place it on their List of World Heritage in Danger in 1996[18].

Tiya is the archaeological site contains 36 monuments, which includes 32 carved stelae covered with symbols hard to decrypt [19].

Tourism in Ethiopia accounted for 5.5% of the country's gross domestic product (GDP) in 2006, having barely increased 2% over the previous year. The government is proving its commitment and willingness to develop tourism through a number of initiatives. Tourism is a featured component of Ethiopia's Poverty Reduction Strategy Paper (PRSP), which aims to combat poverty and encourage economic development [20].

2. METHODOLOGY

To analyzing spatial pattern of tourist places Average nearest neighbor analysis function was used. eq.1

$ANN = \text{Nearest Neighbor Observed Distance} / \text{Nearest Neighbor Expected Distance} \dots \dots \dots \text{Eq.1}$

Average nearest neighbor distance was calculated of all tourists' places, Northern tourist places, Southern tourist places, Eastern tourist places, Western tourist places and central tourist places.

Along with international Airport major domestic airport was fond based on frequency of flights.

Ethiopia was divided into sixteen different directions considering Addis Ababa as a center. Grouping of tourist places was done based on directions and accessibility. Tourist places were grouped in the same direction based on easy accessibility in terms of road transport.

3. RESULTS

As a result tourist places were grouped in five circuits and corridors. These circuits and corridors are shown in figure 1. Northern circuit is an important tourist place in Ethiopia; it covers an distance of 797.7 km. All the tourists places in the Northern circuit are listed in UNESCO world heritage sites. Origin point for eastern, western and central circuits was chosen Addis Ababa. Lower valley of Awash is an important tourist place listed in UNESCO world heritage list is not incorporated because of its outlier location.

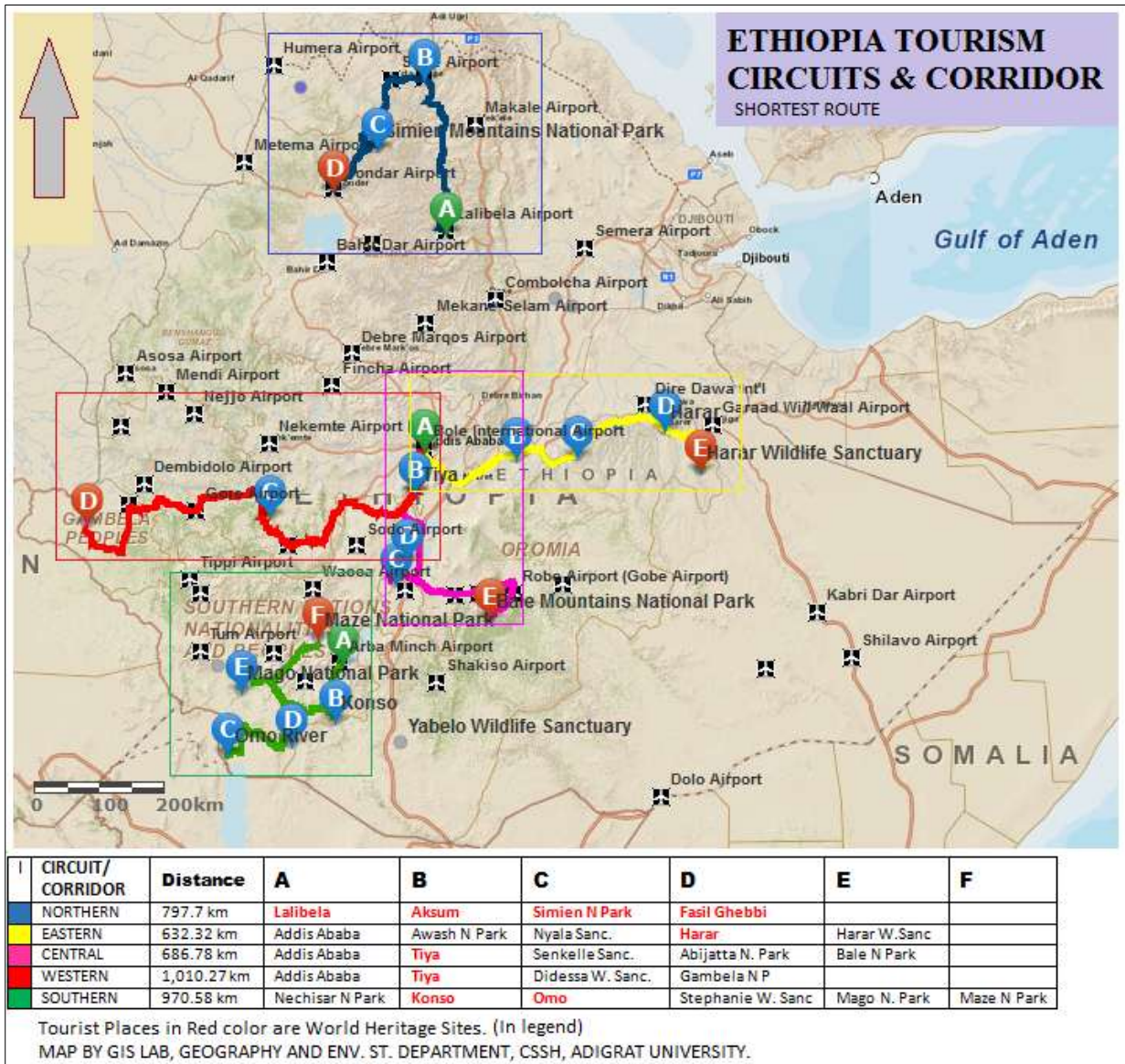


Figure 1

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