The Dynamic Impact of biodiversity on Tourism: empirical evidence from Gambia

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Abstract

The recent infrastructural development and industrial actions around tourism development areas has increased which led to the degradation of coastal sites and protected areas in the Gambia, posing a threat to biodiversity loss and ecotourism. Thus, the research investigated the impact of biodiversity on tourism in The Gambia using the ARDL model between the periods of 1995-2020. The analysis has shown that biodiversity promotes tourism both in the short and long term. Similarly, economic growth has a positive impact on tourism. One of the policy implications is that, since tourism industry depends on the existence of biodiversity, therefore, biodiversity preservation should be a major interest for business sustainability by allocating resources for its preservation, in order to increase the viability of the sector.

Keywords: biodiversity, tourism sector, The Gambia, ARDL, economic growth.

1.0 Introduction

Tourism industry is believed to play a pivotal role in advancing the economic sector of a country by contributing foreign exchange revenues, and gives communities access to wealth, employment and business prospects. In 2014, travel and tourism generated 276.8 million jobs worldwide, or 9.4 percent of all employment, and contributed 9.8 percent to all the global gross domestic product (GDP) (WTTC, 2015). Similarly, for the same period the tourism industry saw a record-breaking 1.133 billion foreign visitors arrive around the world, generating USD1245 billion in revenue (UNWTO, 2015). The emphasis on visitors wanting to view wildlife or plants in their natural environment distinguishes nature tourism from some other types of ecotourism. They could be genuine Eco tourists, specialized observers like birdwatchers, or participants in planned tours that include few stops at wildlife reserves.

Data on the scope and potential of ecotourism or environment tourism are difficult to come by because it is difficult to define a clearly bounded collection of travelers. Based on UN and WTO

data, a widely-cited research by (Filion et al 2020). Predicted a growth rate of 7% annually for nature tourism. Ecotourism accounts for 40-60% of foreign tourism in areas with biodiversity or charismatic wildlife, while wildlife-related tourism accounts for 20-40%. Mass extinction is occurring on Earth, and its effects will influence all current and future generati ons of life. One of the biggest concerns to the globe is the loss of biodiversity. Marine, terrestrial, and other aquatic ecologies around the world have all been destroyed by human activity. (Joof et al., 2022). The value of the international services provided by biodiversity, including carbon sequestration, water purification, crop pollination, and food safety, is estimated to be between $125 and 140 trillion annually, or more than 150% of the amount of the global GDP (OECD 2019).

The ecosystem and its products and services are affected by global warming, which poses a serio us risk to biodiversity (IPCC 2001). Additionally, research has shown that climate change has an impact on biodiversity by constructing new physical features that alter species migration patterns, habitat ranges, species distribution, life cycles, and the emergence of pest and disease epidemics. Sintayehu (2018). One of the factors influencing the choice of a tourist site might be considered to be environmenta l amenities. Environmental quality is frequently employed as a foundation for a marketable tourist attraction. It has been demonstrated that the type and extent of environmental resources surrounding a site are closely linked to the profitability of the tourism sector. (Marcouiller and Prey 2005). According to (Huybers and Bennet 2003) a greater variety of environmental amenities could give the destination a competitive edge or benefit when compared to other destinations, whether they are local or foreign. Furthermore, the authors hypothesized that the biodiversity profile of the destination can be viewed as a significant supply side component of environmental amenities. Similarly, a positive tourist experience depends in part on the health of marine ecosystems since tourists interact with the sea through activities including sunbathing, snorkeling, diving, and glass bottom boats (Arabadzhyan et al., 2021: Scott et al., 2012). Sea activities and sports may be severely impacted by the loss of biomass and biodiversity, the degradation of cleanliness and water transparency brought on by sea water heating, acidification, and human pressure (Belgrano and Villasante, 2021). This could damage the reputation of coastal tourism, research contributions on the relationship between physical and socioeconomic repercussions are rarely achieved (Arabadzhyan et al., 2021; Gissi et al., 2021)

On the other hand, tourism growth impacts biodiversity via various channels. The most noticeable and immediate effect is the clearing of vegetation to make way for tourism-related infrastructures.

Despite the little infrastructure for recreation and tourism within protected areas, tracks, trails, roads, lookouts, fixed campsites, and other forms of lodging are frequently offered, all of which have effects on biodiversity (Newsome et al., 2012). Native vegetations are removed during the construction of huts, lodges, hotels, highways, campgrounds, and other facilities and replaced with either non-native vegetation or a built environment (Spellerberg, 1998). Despite the fact that the space dedicated to infrastructure for recreation and tourism may be relatively small in comparison to the entire area of a park, the effects there are strong and frequently long-lasting (Smith and Newsome, 2002;Kelly et al 2003; Scherrer and Pickering, 2006). For rare and threatened plants the impacts of tourism are particularly severe as these species are already at risk of extinction.

The Gambia's biodiversity is most seriously threatened by the degradation of natural ecosystem especially forests and mangroves. This includes a wide range of issues that directly affect the health of natural ecosystems, such as the extinction of animal and plant species, the degradation of terrestrial and ecosystems and the devastation of scenic places (CBD Strategy and Action Plan - Gambia 2015-2020Delft hydraulics, 1992). Specific biodiversity conservation commitment stretches from 1977 when the president made a declaration on the conservation of wild flora and fauna which is popularly known as The Banjul Declaration.

The most affected sites are around the coastal areas which are also the tourism development areas. like sand mining in kombo south, the destruction of the Tambi wetlands and the most affected protected site in the Gambia is the Bijilo Forest Park commonly called (Monkey Park. Due to it being the first stop for tourist that are interested in birdwatch and monkeys. The Gambian sun squirrel, African civet, genets, mongooses, brush-tailed porcupine, among other smaller, are other mammal species that can be seen (Camara 2012).

For students and researchers both national and international the park is used for scientific and educational study. Even though this justifies it, unfortunately in 2018 some part of the park was demolished to construct the OIC conference center. When the conference center site was cleared, both the little pool that the park's monkeys relied on for drinking water and the fruit trees that served as a crucial source of food were all gone (The Gambia experience 2022). Recently the Ministry of Justice on 28th October 2022 have released a press statement, notifying Gambians that the Government of the Gambia has decided to sell the said land to the Government of the United States of America, where it planned to build the state-of-the-art US Embassy in Gambia. Numerous

well-known Gambian environmentalists and conservationists have denounced the sale of 10 hectares of coastal land to the US Embassy housing the West African Livestock Center (WALIC) and portion of Bijilo Forest Park. They argued, is a threat to the fauna and flora of the country as well as the future generations of Gambians. The rest of the paper is structure as follows: section 2. Presents the literature review, section 3, is the methodology, section 4, is data presentation and analysis, and section 5, is conclusion and policy recommendation.

2.0 Literature

The aim of this paper is to portray the positive ecological impact on tourism. Andereck and Nyaupane, 2011) in their research using an Appreciative Inquiry (AI) on linkages among biodiversity, livelihood, and tourism from the period of 1996 to 2008. The results indicate that tourism helps change local people's attitudes toward the conservation of biodiversity and reduce people's dependence on natural resources. Tourism, particularly small-scale and locally owned ecotourism ventures, is also identified as a tool to enhance the livelihoods of people around protected areas. Nevertheless, we also acknowledge that the tourism industry has a significant positive impact on the country's economy, there are also certain drawbacks, particularly with regard to the environment. The loss of biodiversity is a critical component of negative effects brought on by rising tourism activities. The tourism industry and its associated activities have therefore been acknowledged for their detrimental effect on the environment and threatened species. In a research done conducted by the UN Environmental Programme and Conservation Interventional (CI), (UNEP)

According to Christ et al. (2003) the tourist related activities that cause biodiversity loss can be caused by: (i) habitat disruption as a result of total landscape transformation for tourism development (infrastructure and facilities) in a quick and unplanned manner, which resulted in deforestation and drainage of wetlands, (ii) problems with littering and water pollution, (iii) depletion of scarce resources for indigenous and local people (e.g., water and electricity consumption), and (UNEP, 2013). Nevertheless, according to (UNWTO, 2011), from 2010 to 2030, there will be an average global rise in visitor numbers of 3.3% every year. Between 2010 and 2030, there will be an average 43 million more foreign tourists arrival yearly. As a result, it is inevitable that the environmental effects that come along with this growth in tourism numbers will also increase (Pickering and Hill,2007; Buckley, 2004). However, climate, culture, history, and the surrounding

natural environment are some of the specifics of the site that determine its attraction (Leiper, 1979; Crouch 1995; Witt and Witt 1995; Lim 1997; Muir-Leresche and Nelson 2000; Song and Li 2008). The relationship between biodiversity and travel patterns in emerging nations has been examined in a few recent studies.

Independent of any other conditions, Naidoo and Adamowicz (2005) found that when the variety of bird species rose in a park in Uganda, tourists showed a greater desire to visit a protected region. In their analyses of biodiversity as a driver of economic growth in developing nations, (Freytag and Vietze, 2006, 2007) explore a theoretical model and provide evidence in support of this crucial premise with framework of an empirical analysis. Freytag and Vietze (2010) explore the underlying hypothesis that a rich biodiversity provides a comparative advantage in tourism for most of developing countries. They estimate the empirical effects of biodiversity on tourism flows in developing countries, showing that biodiversity increases tourism flows. There is a lot of literature on recreation in nature (Shrestha and Loomis 2001, 2003, Brander et al.,2007). Tourism and recreation are distinct from one another because the former requires at least one overnight stay. Since recreation is more narrowly oriented than tourism, a vacation could include nature, culture, entertainment, and relaxation. Therefore, the effect of nature on tourism is more pervasive than the effect of nature on recreation. While normal recreation studies suffer from selection bias, the sample of tourist utilized in this study is a representative of the population.

3.0 Methodology

3.1 Data

To investigate the impact of biodiversity, Tourism (TUR), trade openness (TO) and gross national product (GDP), we use annual data from the World Bank development indicators (WDI) between the periods of 1995-2020. Tourism has been used as the dependent variable (TUR) and biodiversity and economic growth as the independent variables while trade openness as the control variables. All the variables were converted to their natural logarithmic forms. The log conversion has been employed to make sure that all the variables are in percentage in order to make it easier to describe the outcome.

$$LTUR_t = LBIO_t + LTO_t + LGDP_t + \varepsilon_t$$

Where LTUR is the log of tourism sector, LBIO is the "log of biodiversity, LTO is the log of trade openness, GDP as the log of gross domestic product and the ε_t is to error term".

Table 1: description of the variables

Variables	definition	Unit	Source

LTUR	number of tourists arrival	Thousands	WDI (2020)
LBIO	Biodiversity habitat index	A score of 0-100	Yale (2020)
TO	Trade as a percentage of GDP	%	WDI (2020)
GDP	GDP per capita	%	WDI

3.2 ARDL Technique

The ARDL by Pesaran et al. (2001) approximation has three major advantages in contrast to traditional cointegration techniques. All the variables are not necessary for ARDL to be in the same line, in another words the integration of the series can be at I(0) and/or I(1). Additionally, the ARDL analyses performs better using sizeable data. In conclusion, it ensures fair estimation (Harris and Sollis, 2003).

3.3 Unit Root Test

Before using the ARDL, variables should either be stationary at level I(0), or stationary at first difference I(1) or have mixed I(0) and I(1). This study applied the Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) unit root test to identify the order of integration of the data.

3.4 Bound Test of Cointegration

After using the unit root test, the bound test of cointegration is performed to affirm the long-run cointegration among the variables. According De Vita et al (2006), all the variables must be I(0) or I(1) to make certain of the assumption of the ARDL bound test of cointegration, and that under no circumstance should a variable be I(2) and that the dependent variable should be I(1).

The tested hypotheses are: $H_0 = \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = 0 \, and \, H_1 \neq \sigma_1 \neq \sigma_2 \neq \sigma_3 \neq \sigma_4 \neq 0$ for the null and alternative hypotheses, subsequently, in equation (2) under. The existence (or nonexistence)

of cointegration is established once the "F-statistic (Fpss)" is more than the "critical values" at the upper bound.

At the same time, if the F-statistic is between the lower and upper bounds. It shows an indecisive results of cointegration. The long and short and short-run ARDL equation:

After applying the unit, the bound test of cointegration is applied to confirm the long-run cointegration between the variables. According to De Vita et al. (2006), each of the variables must be I(0) or I(1) in order to satisfy the assumption of the ARDL bound test of cointegration, and that under no conditions should a variable be I(2) and that the dependent variable should be I(1).

The hypotheses tests are: $H_0 = \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = 0 \, and \, H_1 \neq \sigma_1 \neq \sigma_2 \neq \sigma_3 \neq \sigma_4 \neq 0$ for the null and alternative, respectively, in equation (1.1) below. The presence (or absence) of cointegration is confirmed once the "F-statistic (Fpss)" is higher than the "critical values" at the upper bound. Equally, if the F-statistic is in the middle of the lower and upper bounds, it implies an indecisive outcome of cointegration. The long and short-run ARDL equation:

$$\Delta LTUR_t = \gamma_0 + \sum_{i=1}^{n} y_{1i} \, \Delta LTUR_{t-i} + \sum_{i=1}^{n} y_{2i} \, \Delta LBIO_{t-i} + \sum_{i=1}^{n} y_{3i} \, \Delta LTO_{t-i} + \sum_{i=1}^{n} y_{4i} \, \Delta GDP_{t-i} + \sigma_1 LTUR_{t-1} + \sigma_2 LBIO_{t-1} + \sigma_3 LTO_{t-1} + \sigma_4 LGDP_{t-1} + \varepsilon_{1t} \quad (1.1)$$

While the ECM (error correction model) is used to estimate the short-run dynamic equation, which incorporates the speed of adjustment as shown below:

$$\Delta LTUR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \, \Delta LTUR_{t-i} + \sum_{i=1}^{n} \beta_{2i} \, \Delta LBIO_{t-i} + \sum_{i=1}^{n} \beta_{3i} \, \Delta LTO_{t-i} + \sum_{i=1}^{n} \beta_{4i} \, \Delta LGDP_{t-i} + ECM_{t-1} + \mu_t \quad (1.2)$$

Where:

Δ= change in the variables

n= optimal lag number, the lag selection is based on the Akaike Information Criterion (AIC)
ECT_{t-1} = "one period lagged error correction term of the long run estimate," Gujarati (2003) predicted to be negative and significant.

ε_{1t} =error condition.

4.0 Data Presentation and Analyses

4.1 Unit Root Test

Table two shows the ADF and PP unit root analyses. Base on the ADF, GDP, Tourism and trade openness are not stationary at level i.e I(0), but are stationary at first difference i.e I(1). Only biodiversity is stationary at I(0). The null hypothesis of unit roots is rejected at 5% significant level, thereby indicating the acceptance of the alternative of stationarity. Furthermore, the PP reveal that economic growth an trade openness are stationary at I (1) while biodiversity and tourism are stationary at I(0) This indicates that both the results from the PP and ADF affirms mix order of integration among the variables. Thus, meeting the prerequisites of ARDL.

Table 2: Unit Root Test

	Intercept and Trend			
	ADF		PP	
	I(0)	I(1)	I(0)	I(1)
Variables	t-statistics	t-statistics	t-statistics	t-statistics
BIO	-4.039**	-5.818	-4.129**	-5.688***
TO	-2.959	-4.210	-2.983	-5.637***
TUR	-2.959	-11.044 ***	-4.554**	-3.188***
GDP	-2.196	-4.745***	-2.296***	-4.747***

Note: BIO is biodiversity, TUR is tourism, GDP is economic growth and TO is trade openness, ***, **, * is 1%, 5% and 10% significance level.

4.3 Multicollinearity Tets

Table 3 represents the correlation among the variables. The analyses a weak correlation between GDP and biodiversity, similarly the correlation between trade openness and biodiversity is weak. The highest correlation coefficient between GDP and trade openness stood at 69% which is less than the 80% rule of thumb. This concludes that the model is not suffering from what is called multicorelinearity

Table 3: correlation metrics

Variables	BIO	GDP	TO
BIO	1.000		
GDP	0.277	1.000	
TO	-0.199	-0.691	1.0000

Note: BIO is biodiversity, GDP is economic growth and TO is trade openness.

4.3 Bound Test of Cointegraton

The bound test of cointegration is shown in table 4. The analyses revealed an F-statistic of 4.497, which is higher than the upper and lower bound critical values. Thus highlighting the presence of cointegration or long run relationship between biodiversity, GDP, tourism and trade openness.

Table 4: bound test of cointegration

Variables	F-statistics (Fpss)	Bound critical value**		Cointegration
		I(0)	I(1)	

TUR =f(BIO, TO, GDP)	4.497	2.79	3.67	YES

Note: BIO is biodiversity, TUR is tourism, GDP is economic growth and TO is trade openness.

4.4 ARDL Analysis

After confirming mix order stationarity and cointegration between the variables we applied the ARDL model proposed by pesaran et al (2001). Base on the ARDL analyses the ECM revealed a coefficient of -0.69, indicating a speed of adjustment of 69% at which the disequilibrium among the variables is corrected in the long run. According to Gujarati (2004) the ECM should be negative and significant: this means that our model is reliable. The short and long run analyses indicated that biodiversity have a positive and significant effect on tourism. Implying that a 1% increase in biodiversity will increase the number of tourist arrivals by 1.5% and 2.24% in the short and long run respectively.

This finding can be attributed to the increasing eco-protected sites (Tanji bird reserve, bijlo Monkey park, Tanbi wetlands, and kartong reptile farm) around the coastal areas in The Gambia, because a good environmental condition promotes tourism attraction. This have triggered an increase in both domestic and international tourists as students of both local and international visit these areas for different reason ranging from bird watching and research. Likewise, the quality of marine ecosystems (sand and sea) attracts and enhances tourist participation in activities like surfing, diving and fishing.

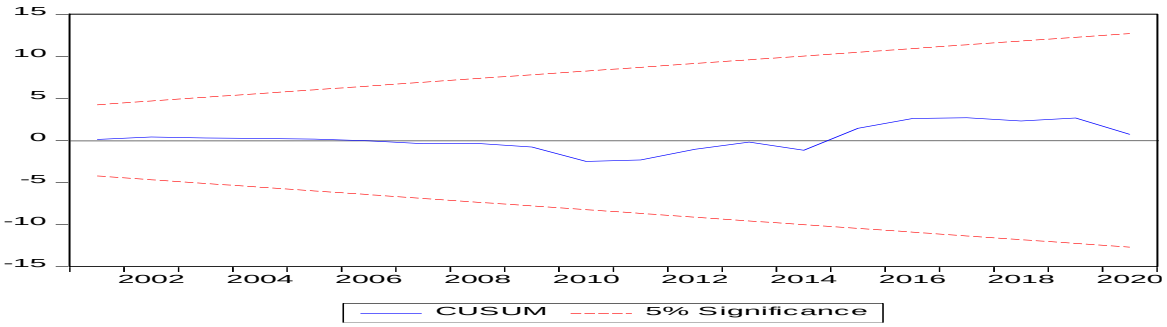
Similarly economic growth was found to positively affect tourism in the Gambia. The outcome indicated that a percentage increase in economic growth will promote the tourism industry by 1.2% in the short run and 1.7% in the long run. Economic growth may improve tourism sector via the tourism led growth proposition which lays emphasis on the development of tourism infrastructure and recreational facilities. This in turn attracts tourist arrival to a destination. Furthermore, an increase in economic growth means an increase in income. High income may boost or promote the tourism sector through domestic tourism. Finally the results also revealed a positive relationship between trade openness and tourism suggesting that an increase in trade openness triggers a surge in tourism sector. Based on the diagnostics the model is not suffering from autocorrelation as evidence by the Dubin watson statistics of 1.95 and the LM serial correlation test with p-value of 0.150 which is greater than the 5% significance level. Moreover the model is homoscedastic, because the null hypotheses of heteroscedasticity is rejected. Hence the P-value is greater than 5% significance level. The P-value of 0.111 is greater than the 5% significance level. According to the jaque-Bera test the variables are normally distributed. The CUSUM test result in figure.1 suggest that the model is stable hence the blue line is between the 5% significance boundaries as indicated in red lines.

Table: 5 Short and Long Run ARDL

	Short run		Long run	
Variables	Coefficient	p-values	Coefficient	P-Value
BIO	1.551***	0.000	2.238***	0.000
GDP	1.202***	0.014	1.734***	0.005
TO	2.224***	0.003	3.208***	0.001
TUR (-1)	-0.693***	0.000		
ECT(-1)			-0.693***	0.000

Diagnostics	Statistics
Hetroskedasticity	0.111
Autocorrelation	0.150
Normality	0.166
Dubin Watson	1.945

Note: BIO is biodiversity, TUR is tourism, GDP is economic growth and TO is trade openness, ***, **, * is 1%, 5% and 10% significance level.



5.0. Conclusion

This study investigate the impact of biodiversity on the tourism sector in the Gambia using the autoregressive distributed lag model from 1995 to 2020. The results indicates that biodiversity conservation promotes tourism sector development both in the short and long run. Furthermore, both economic growth and trade openness were found to exhibit a positive relationship with tourism sector.

5.1 policy implication and recommendation

In this research we investigate the impact of biodiversity on tourism. The investigation measure tourism by the amount of inbound tourist arrivals, on the other hand biodiversity is measured on the impact it has on the number of international tourist visit. Our findings clearly shows the positive impact biodiversity has on tourism. As tourism is dependent on biodiversity, it's important that every stakeholder in the industry play their role in protecting our biodiversity. Thus if the biodiversity is protected, the tourism industry will be significantly boosted as well as the local neighborhoods whose income is dependent on the tourism sector as well as other stakeholders in the tourism sector such as the tour operators, lodgings, restaurants, petty traders and numerous services for amusement and recreation. Therefore, it should be understood that tourism sector's commercial operation heavily depends on biodiversity, and that no enterprise can be sustained without a rich biodiversity. As the tourism industry depends on the existence of biodiversity, so biodiversity preservation should be a major interest for business sustainability by allocating resources for its preservation, in order to increase the viability of the enterprise. Some recommendations can be made from this research. As indicated by (UNWTO, 2011), from 2010 to 2030, there will be an average global rise in visitor numbers of 3.3% every year. Between 2010 and 2030, there will be an average 43 million more foreign tourists arrival yearly. This we know

will also have an implication on the environment. Therefore, as policy makers there is a need to invest more on ecotourism as it offers more sustainability for the tourism industry. Additionally, ecotourism includes a vibrant social component. It is geared towards helping residents in using their lands and resources more sustainably and to give them influence over how tourism develops in their area. The government must take additional steps to promote conservation and enact more environmental protection initiatives if ecotourism is to succeed. Moreover, the government and stake holders in the industry should have partnership educational programs with environmental specialist and activist to encourage and raise more awareness in protecting the biodiversity by promoting eco-friendly tourism.

The main limitation of this study is the absence of a historical background on biodiversity due to data unavailability. Secondly, the time span of the series, starts from 1995 to 2020 due to missing observations on biodiversity. For further studies, other scholars may extend the current research by employing other indicators of biodiversity (number of threatened species) and or using a panel data analysis.

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