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BIODIVERSITY CONSERVATION EFFORTS AMONG MUSLIM COUNTRIES: EVIDENCE FROM THE ORGANIZATION OF ISLAMIC COOPERATION COUNTRIES

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ABSTRACT

According to mainstream literature, Muslim countries often lag behind in terms of environmental sustainability despite their being fully compliant with global environmental regulations. This raises the question of whether this applies to all aspects of environmental conservation. Therefore, this paper aims to evaluate the effectiveness of biodiversity conservation efforts in countries that are members of the Organization of Islamic Cooperation (OIC) and determine whether a consistent growth trend in biodiversity conservation can be identified.

The study employs semi-quantitative and policy-science methods, analysing data from Yale University's Biodiversity and Habitat Protection Index from 2010 to 2020. The findings show a significant increase in biodiversity conservation performance over the ten-year study period. Interestingly, low-income countries outperformed their wealthier OIC counterparts in terms of biodiversity conservation, despite having the lowest economic development status. This positive trend highlights the effectiveness of essential biodiversity policies and measures adopted in these Muslim countries. Furthermore, these results align with Stern's approach, which argues that economic expansion can have diverse impacts on environmental quality, leading to the rejection of the Environmental Kuznets Curve hypothesis in the context of biodiversity conservation in Muslim countries. The study emphasises the need for further research into the nature of biodiversity policies among low-income nations. The policy ideas and solutions from these countries can provide valuable insights for combating biodiversity loss within OIC countries and globally, contributing to achieving Sustainable Development Goals (SDGs). Additionally, it has the potential to enhance the capacity of OIC countries in biodiversity conservation and their role in supporting fellow Muslim nations in achieving the SDGs.

Keywords: OIC, Muslim countries, biodiversity, conservation, environmental sustainability, SDG.

INTRODUCTION

Over the past three decades, notable developments have taken place in scientific research related to policy analysis, giving rise to the emergence of the science-policy interface (Bednarek et al., 2018; Reed & Rudman, 2023). The science-policy interface can be defined as the social processes that involve interactions between scientists and other actors in the policy realm. These interactions facilitate knowledge exchange, co-evolution, and collaborative knowledge construction to enhance decision-making (Jagannathan et al., 2023). Scholars emphasising the science-policy interface underscore the importance of ensuring sustainability by considering knowledge, interests, and objectives within the context of scientist-government relations during policy processes (Craig, 2019). This area of research focuses on preserving biodiversity through the lens of sustainable

science (Ehrlich & Wilson, 1991) and within the sphere of public policy (Wyborn et al., 2019). The relationships between science and governments have influenced traditional biodiversity perspectives, such as the interplay between cultural and biological diversity (Chiu et al., 2020), as well as genetic engineering and conservation biology, which can support the commercialisation of biodiversity for new industries (Lepofsky, 2009). Within the analysis of public policy and international relations, the science-policy interface has emerged as a shared vision for environmental protection and politics (Lahsen, 2009), particularly concerning natural resources and biodiversity preservation (Dickens et al., 2020; Ehrlich & Wilson, 1991). Human behaviors can be influenced by governmental policies, which can have both positive and adverse consequences. On the one hand, these activities contribute to biodiversity loss, while on the other hand, they offer opportunities for economic development and ecosystem protection.

The present research emphasizes the policy perspective on environmental protection, recognizing the interconnectedness of biodiversity conservation and the interaction between science and policy as manifested in state policy choices. States are critical in defining activities to protect biodiversity within the policy process. Biodiversity conservation, at this point, falls within the scope of biodiversity governance, which plays a strategic role in the sustainability of natural resource management and legitimacy (Jenkins et al., 2012). The state's responsibility includes incorporating sustainable practices in biodiversity conservation within its operational management and jurisdictions. Moreover, effective policy implementation is essential to prevent environmental issues and crises in each country.

However, the extent to which states effectively control and prevent biodiversity destruction remains uncertain, particularly in developing countries within the Muslim world. There is a lack of comprehensive studies that delve deeper into this matter. Moreover, when it comes to environmental issues, the impact of modernisation, which renders Muslim countries highly susceptible to environmental degradation caused by escalating man-made activities and deforestation linked to agriculture, is a recurring issue faced by Muslim countries in the Muslim world (Febriyanti et al., 2022). Furthermore, concerning environmental matters, the recurring issues faced by Muslim countries in the Muslim world are the consequences of modernisation, which make them highly

vulnerable to environmental degradation resulting from escalating human activities (Butt & Салим, 2020) and deforestation related to agriculture (Febriyanti et al., 2022). Additionally, according to some political science scholars, in addition to the impacts of modernisation observed in developing nations, Muslim countries are also perceived as "the other" (M. El-Awaisi & al-Fattah, 2012). This highlights the following two specific gaps: first, the efforts of low-income Muslim countries towards enhancing environmental management are not sufficiently recognised in current international development policies; and secondly, there is often a lack of acknowledgement regarding the direct involvement of Muslim countries in international affairs within studies on international relations (Wahid et al., 2023). The focus of this paper is to evaluate the effectiveness of biodiversity conservation efforts in Muslim countries, particularly within the context of the Organization of Islamic Cooperation (OIC) member states. The paper aims to analyse the political stance and environmental behaviour of governments in Muslim countries by assessing their efforts in biodiversity conservation. It aims to determine if there is a consistent positive trend in biodiversity conservation.

Conserving biodiversity is vital in OIC countries for several reasons. Firstly, the OIC encompasses a wide range of terrain and ecosystems, and its member countries are blessed with abundant natural resources and biodiversity. The majority of the world's natural richness is found in megadiverse countries, and Malaysia and Indonesia are representative of the OIC member states in this group. According to Wolf et al. (2022), despite being among the affluent countries in the OIC, the biodiversity conservation scores of Malaysia and Indonesia have decreased from 55.1 and 56.3 in 2020 to 51.90 and 51.20 in 2022, respectively. This decline is concerning, as there is a risk that they may ultimately lose their place in the mega-biodiversity group.

One of the biggest challenges faced by contemporary civilisation is the threat of biodiversity loss. This problem affects industrialised nations disproportionately (Forester & Machlist, 1996). Developing countries hold greater hope, yet governance for biodiversity and human survival remain inadequate. (Jenkins et al., 2012). Transformative governance is necessary for achieving the Sustainable Development Goals (SDGs), and empowering minority groups that contribute to sustainability and highlighting their roles in this regard (Visseren-Hamakers et al., 2021). The importance of biodiversity conservation cannot be overstated, and

it is essential that there is a productive and efficient dialogue between biodiversity science and policy. This is where policy and political studies play a crucial role. Developing countries have the potential to take the lead in addressing these issues, and it is vital to recognise their role (Young et al., 2014). This paper aims to assess the effectiveness of biodiversity conservation efforts in countries that are members of the OIC. It also seeks to investigate if there is a consistent positive trend of growth in biodiversity conservation. The findings of this study will determine the validity of the Environmental Kuznets Curve (EKC) theory in the context of biodiversity conservation in Muslim countries. The EKC theory proposes a non-linear relationship between economic progress and environmental degradation. It is named after economist Simon Kuznets, who suggested a similar notion regarding income inequality (Van Dyke & Lamb, 2020). According to the EKC hypothesis, economic growth initially contributes to biodiversity loss, but as countries achieve higher economic growth, environmental degradation decreases (Stern, 2004).

LITERATURE REVIEW

The term "development" finds widespread usage in various sociological writings. It is particularly emphasised by countries, especially as they strive to achieve the United Nations' SDG by 2030. In its most fundamental sense, the word 'development' refers to a process, and in modern contexts, the process is a march towards a state that some of the world's nations are said to have attained. In the context of this paper, "development" refers to the progressive transition from construction to the expansion and improvement of a country's endeavours in environmental management. It uses the basic definition of development borrowed from Mair (1984). The word "biodiversity" encompasses the entire range of life, spanning genetic, biochemical, physiological, morphological, taxonomic, and behavioural diversity of individual organisms to the intricate relationships within multispecies communities and ecosystem processes" (Johnson, 2019: 25). The definition also includes the following facets: genetic - the genetic information present in every plant, animal, and microorganism on Earth (Wang, 2020: 137), species - the entire array of plant, animal, and microorganism species found on Earth (Wang, 2020: 137–138), and habitat protection - the habitat of an organism, where individuals, populations, and communities undergo their life processes (Huang

et al., 2019: 402). Biodiversity conservation in this paper refers to human intervention in species and ecological systems which aims to optimise the present utilisation of these two systems, while preserving their capacity to fulfil the needs of future generations (Zhang et al., 2012: 274). Most governments often inadequately address the political and policy aspects of biodiversity conservation, which constitute the science-policy interface (Mehring et al., 2017). This is partly due to the assumption that a specific policy approach is suitable for driving scientific and technical conservation management (Bliese, 2020; Lawton & Rudd, 2014). Additionally, the contributions of environmental movements to biodiversity conservation policy in OIC countries, except for specific cases like Indonesia (Mangunjaya, 2011) and Iran (Jowkar et al., 2016), remain ambiguous.

Extensive studies have been conducted on the performance of biodiversity conservation worldwide. Several high-income countries outside the OIC, such as the USA, France, United Kingdom, Australia, and New Zealand, have witnessed an increase in the establishment of biodiversity conservation, such as marine protected areas (Maestro et al., 2019). This trend aligns with the growing interest, particularly in the 21st century, among high-income countries to create and manage protected areas (Maestro et al., 2019). European Community countries located near the Great Adriatic Plain, including Croatia, recognise the biodiversity richness of the Great Adriatic Plain landscape as a vital source of habitats and biome diversity (Sršen et al., 2014). Malta, despite being a densely populated (1,265 inhabitants per square kilometre) (Gruppetta et al., 2013) and small island nation with limited terrestrial area (Médail, 2017), has made significant commitments to enhancing biodiversity conservation, mainly through the preservation of biomes and the expansion of marine protected areas (Spiteri & Stevens, 2019). In South America, particularly in the south-western stretch of the Bahamas, the Yucatan Peninsula, and Cuba's northern barrier islands and western shores, and countries such as Ecuador, Colombia, Venezuela, Brazil; these areas and nations have made noteworthy contributions to biodiversity conservation, particularly in preserving mangrove forests, which significantly contribute to the global biome total (Blackman et al., 2014).

Conversely, a lack of comprehensive research regarding the effectiveness of biodiversity conservation in Muslim countries exists in the literature. Firstly, historically in the OIC member

states, policy development has been disproportionately influenced by the environmental narratives and historical experiences of the Arab countries (Akbarzadeh & Ahmed, 2018; Foltz, 2020; Ismail et al., 2019). Secondly, some scholars believe that environmental policies implemented in affluent Western countries are more effective than those in countries which are predominantly Muslim (Kula, 2001; Saniotis, 2012; Saniotis & Nazif, 2006; Wersal, 1995). Thirdly, according to some authors, although Muslim countries have committed to global environmental standards, they often exhibit slower progress in terms of environmental performance (Butt & Салим, 2020; Mohamed, 2014; Özler & Obach, 2019; Saniotis, 2012). Fourthly, there is also the view that governments in Muslim countries often face the dilemma of striking a balance between economic development and environmental sustainability (Ardalan, 2014; Miller, 1992; Smith & Miller, 1996; Young et al., 2014). As the sole internationally recognised organisation representing Muslim nations, the OIC countries adhere to the principles and mandates of the United Nations (UN) when participating in UN environmental conservation programmes. However, developing nations with their domestic policy priorities encounter difficulties committing to global biodiversity and habitat protection when implementing national biodiversity governance mechanisms aligned with the SDG.

Consequently, achieving effective biodiversity policy and management in developing nations poses a significant challenge (Young et al., 2014). Nonetheless, it is imperative to reassess this antiquated belief, especially when considering biodiversity conservation. This is due to diverse policies aimed at addressing biodiversity loss, each tailored to the unique national environmental experiences of individual countries. Thus, this paper fills the gap by highlighting the status of biodiversity conservation performance in the OIC countries. This paper addresses a significant gap in international environmental politics, particularly concerning the environmental foreign policy of Muslim countries in the Global South. In the existing literature, Ismail et al. (2019) highlight the outstanding environmental performance of wealthy Muslim states. Their study uses the Yale University environmental performance index to investigate approaches in improving strategies for upper-middle and high-income Muslim nations when addressing environmental performance. According to Ismail et al. (2019), the strategy to adopt should be based on each country's environmental and political economy, existing environmental performance and

ranking, and readiness to learn from the effective environmental foreign policies of other rich Muslim nations. Unlike the previous studies carried out thus far on environmental performance, the present research has focused particularly on the niche issue of biodiversity conservation and policy.

METHODOLOGY

In this study, a combination of semi-quantitative and policy-science methods was employed. The former involved evaluating historical and ranking data (Shook & Grantham, 1993), while the latter utilised country data sets and observed behavioural trends of countries (Dipak, 2011: 249-271). Statistical tests were deemed inappropriate in the present study due to the presence of significant outliers in the sample data (as we utilised all internet samples from the Yale University's biodiversity conservation performance index as the sampling frame). Therefore, the policy-science method was chosen, which involves plotting data series and examining trends (positive growth, negative growth, or fluctuations due to seasonality effects) (Dipak, 2011: 249-240). A combination of semi-quantitative and policy-science methods provides a more reliable approach to evaluating and comparing scores using a rating scale, as opposed to relying on a single method. The study design is primarily qualitative as it involves the secondary analysis of survey data. Secondary analysis refers to the re-examination of pre-existing survey micro-data collected by organisations for research purposes. Survey micro-data refers to the raw data that is available in electronic data files (Nigel & Paul, 2015).

The data collection and analysis process involved two stages. In the first stage, a population of 57 OIC countries was selected as research participants based on an eligibility criterion of being an "OIC member state" (Elfaki & Embi, 2023). Moving on to the second stage, data was collected on the scores for biodiversity conservation and habitat performance in 2010 and 2020, as well as the score growth over the 10-year period, from the 2020 Environmental Performance Index (EPI) by Yale University, as reported by Wendling et al. (2020). The EPI, which was formerly known as the Environmental Sustainability Index (Usman et al., 2019), was developed by the Yale Centre for Environmental Law and Policy (Yale University) and the Centre for International Earth Science Information Network (University of

Columbia) in collaboration with the Joint Research Centre of the European Commission and the World Economic Forum (Wendling et al., 2020). The Environmental Performance Index (EPI) is a ranking system that evaluates countries based on their management of natural resources, sustainability efforts, and public health protection (Wendling et al., 2020). It comprises of 19 categories, including biodiversity conservation (Wendling et al., 2020). The EPI for 2020 provides data on the environmental performance of 180 countries for the past decade, including 2010 and 2020. However, nine countries, namely Palestine, Somalia, Yemen, Syria, Libya, Kyrgyzstan, Nigeria, Turkmenistan, and Iran, were excluded from the analysis due to incomplete data (Wendling et al., 2020). Therefore, the study sample consisted of 48 OIC countries, as is presented in Table 1, which displays the score index of biodiversity conservation and habitat protection for OIC countries in 2010 and 2020.

Table 1

Score Index of Biodiversity and Habitat Conservation of OIC Countries in 2020 and 2010.

Country[1]	Year 2010 (Score X)	Year 2020 (Score Y)	Country	Year 2010 (Score X)	Year 2020 (Score Y)
1. Gabon	66	86	25. Guyana	37.9	51
2. Uganda	82.1	81.4	26. Egypt	49.9	50.6
3. United Arab Emirates	41.5	80.9	27. Cameroon	39.6	48.6
4. Burkina Faso	76.5	77.8	28. Bangladesh	43.3	46.8
5. Niger	60.7	77.6	29. Sudan	62.2	46.6
6. Guinea-Bissau	68.9	72.2	30. Pakistan	46.8	46.1
7. Chad	68.8	69	31. Kazakhstan	40.8	41.6
8. Senegal	67.6	68.7	32. Qatar	43.4	41.3
9. Albania	57.1	68.2	33. Iraq	28.5	40.5
10. Morocco	24.2	67.4	34. Algeria	39.3	39
11. Mozambique	65.2	67.4	35. Saudi Arabia	38.9	38.8
12. Benin	66.3	67	36. Uzbekistan	39.1	37.6
13. Kuwait	32.4	66	37. Tunisia	42.1	37.1
14. Tajikistan	65.4	65.8	38. Comoros	35.9	36.3
15. Togo	63.4	64.2	39. Gambia	31.8	32.6
16. Suriname	60.4	63.6	40. Jordan	27.5	32.2
17. Cote d'Ivoire	66.3	62	41. Oman	27.1	28.2
18. Guinea	60.7	59.9	42. Djibouti	16.6	23
19. Mali	58.3	59.6	43. Afghanistan	22.3	21.9
20. Brunei	58.7	59.2	44. Lebanon	22	21.8
21. Azerbaijan	56.8	56.9	45. Mauritania	19.4	19.2
22. Indonesia	58.4	56.3	46. Bahrain	18.7	18.9
23. Malaysia	63.7	55.1	47. Turkey	15.7	15.1
24. Sierra Leone	45.8	52.9	48. Maldives	4.7	6.5

Note. [1]n = 48, as of 17 July 2023, source is Wendling et al. (2020)

The second step was to develop a definition for "score growth". The assessment of biodiversity conservation progress or development in

this study has employed the term "score growth." The findings of the analysis are as presented below:

$$\text{Score growth} = (\text{Score Y} - \text{Score X})$$

During Stage 2 of this study, a two-point scale was introduced and used to rank the score growth. The scale ranged from 0 to 1 and above, indicating development, and from <0 and below, indicating decline. The scale was adopted from previous research that had examined environmental responsibility preferences in the environmental behaviour of countries (Ismail et al., 2019). Decision analysis techniques were employed with historical data and ranking (Shook & Grantham, 1993), and data series were used to comprehend fundamental behaviour patterns in policy analysis (Dipak K, 2011). The present study has shown that a growth score of "0.1 and above" signifies a positive development in biodiversity conservation performance. It indicates a country's commitment to implementing effective biodiversity conservation policies and achieving substantial growth in biodiversity conservation scores. On the other hand, a score growth falling within the range of "<0 and below" indicates negative growth and deliberate neglect of biodiversity conservation policies by the government. It suggests that the country's growth in biodiversity conservation scores is insignificant.

With regard to the present study, an income category was included based on the World Bank's classification system (The World Bank, 2023). The classification system used the following four categories for economic development in countries: high-income, upper-middle-income, lower-middle-income, and low-income countries. The present study has grouped high-income and upper-middle-income countries together as "affluent" nations, while lower-middle-income countries were classified as economically underprivileged or "low-income" countries. This grouping was determined based on the similarities between categories, as they did not possess distinct characteristics that warranted separate classifications. High-income countries were defined as those with a per capita Gross National Income (GNI) of US$12,536 or more in 2023, while upper-middle-income countries had a per capita GNI ranging from US$4,046 to US$12,535 in 2023. Low-income countries were identified as those with a per capita GNI of US$1,035 or less, to US$4,045 in 2019 (The World Bank, 2023). This per capita GNI range encompassed both lower-middle-income and low-income categories. The introduction of the income level category was aimed at analysing the variations in biodiversity conservation

among different income levels in Muslim countries. Table 2 shows the income groups of OIC countries in 2020, categorising them into the affluent group (high and upper-middle income) and the low-income group (lower-middle and low-income). The low-income group was larger, consisting of 29 countries and accounted for 60.4 percent of the total. On the other hand, the affluent-income group comprised 19 countries, making up 39.58 percent of the total.

Table 2

OIC Countries by Income Group in 2020

Category	Percentage	Freq.	Income category	Country
Affluent	39.58	7	High	Qatar, United Arab Emirates, Kuwait, Oman, Brunei Darussalam, Bahrain, and Saudi Arabia
		12	Upper-middle	Lebanon, Turkey, Indonesia, Malaysia, Gabon, Iraq, Albania, Jordan, Suriname, Maldives, Kazakhstan, and Azerbaijan
Low-income	60.42	12	Lower-middle	Algeria, Bangladesh, Benin, Cameroon, Comoros, Cote d'Ivoire, Djibouti, Egypt, Mauritania, Morocco, Tunisia, and Senegal
		17	Low	Niger, Guyana, Sierra Leone, Guinea-Bissau, Mozambique, Burkina Faso, Mali, Togo, Gambia, Chad, Tajikistan, Afghanistan, Uganda, Pakistan, Guinea, Uzbekistan, and Sudan

RESULTS

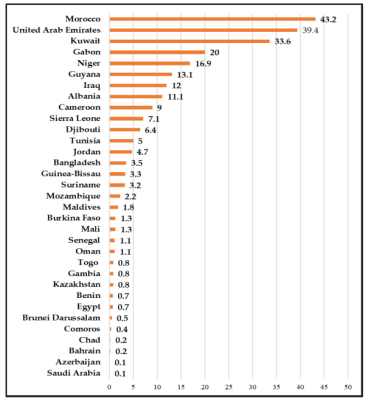
Growth in Biodiversity Conservation Performance

Figures 1(a) and 1(b) depict the biodiversity conservation performance of 48 OIC countries, which have been divided into two groups based on their growth and decline scores. The data reveals an encouraging trend of improvement in biodiversity conservation performance across both affluent and low-income OIC members. As per Figure 1(a), about 68.7 percent (33) of the OIC countries experienced an enhancement in performance, ranging from a modest increase of +0.1 points to a significant increase of +43.2 points. Furthermore, the data suggests that low-income countries have shown the highest score of growth in biodiversity conservation performance. Morocco displayed the fastest growth with a score of +43.2 points, while Saudi Arabia showed the smallest growth with a score of +0.1 points.

According to the results, there has been a decline in biodiversity conservation performance for both affluent and low-income countries. However, the decline was not as significant as the growth rate. It is worth noting that most of the countries in the bottom five were affluent countries. Figure 1(b) shows that around 31.25 percent (15) of the 48 OIC countries experienced a decline in their efforts to conserve biodiversity. These countries included Mauritania, Lebanon, Algeria, Tajikistan, Afghanistan, Turkey, Uganda, Pakistan, Guinea, Uzbekistan, Indonesia, Qatar, Cote d'Ivoire, Malaysia, and Sudan. The decline in biodiversity conservation performance ranged from just below 0 points to as low as -15.6 points. Indonesia (-2.1 points), Qatar (-2.1 points), Cote d'Ivoire (-4.3 points), Malaysia (-8.6 points), and Sudan (-15.6 points) were the bottom five in this ranking, with three out of the five being affluent countries.

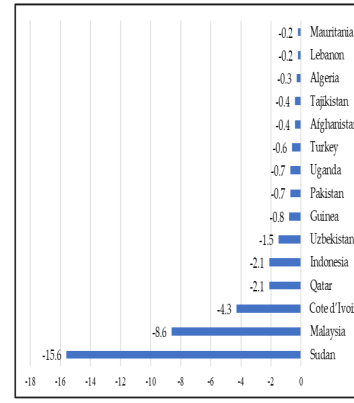
Figure 1(a) and Figure 1(b)

The Performance of 48 OIC Countries Classified into Growth and Decline Score Groups in Biodiversity Conservation



biodiversity conservation performance

(a)



biodiversity conservation performance

(b)

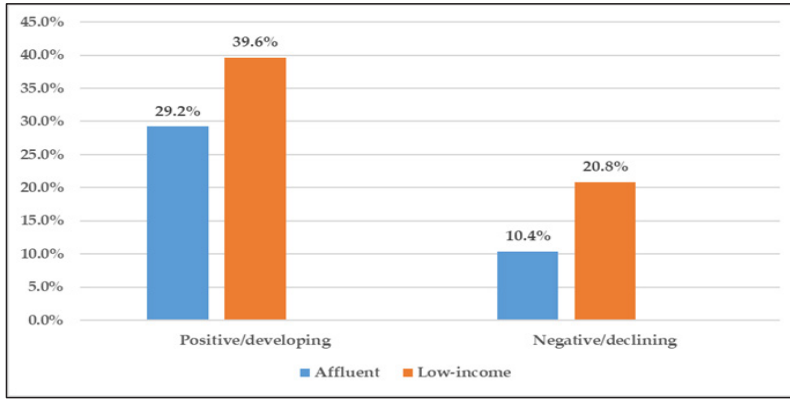
Low-Income Countries Lead Biodiversity Conservation Performance Growth

Figure 2 categorises the OIC countries into affluent and low-income brackets and displays their growth and decline scores for biodiversity conservation performance in 2020. The scores in Figure 2 are based on

the variation in biodiversity conservation performance between 2010 and 2020. The affluent countries (14 out of 19) have a higher percentage than the low-income group (19 out of 29) in terms of growth. Their combined growth percentage was 73.6 percent, while that of the low-income group was 65.5 percent. However, just comparing percentages does not give a clear picture. The crucial aspect is that out of all the 48 countries, low-income countries experienced a more significant growth, with 19 of them (39.6%) falling into the growth score group. On the other hand, only 14 affluent countries (29.2%) were in the same category. The progress shown by low-income countries in managing biodiversity conservation has been remarkable. Despite being economically disadvantaged, they have shown a positive trend in their conservation efforts. This suggests that low-income countries were leading in the OIC's biodiversity conservation performance.

Figure 2

The Growth and Decline Scores of Affluent and Low-Income Categories of OIC Countries in 2020



Figures 3(a) and 3(b) illustrate the biodiversity conservation performance of the top five and bottom five OIC countries in 2020. Gabon, Uganda, United Arab Emirates, Burkina Faso, and Niger were the top five countries, with Uganda achieving the second-highest score of 81.4 points. Surprisingly, three of the top five countries belong to the low-income group, namely Uganda, Burkina Faso, and Niger.

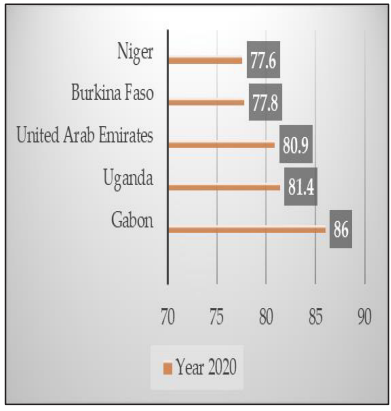
In contrast, the bottom five countries were Lebanon, Mauritania, Bahrain, Turkey, and Maldives. Bahrain was part of the high-income

group, while Turkey, Maldives, and Lebanon were part of the upper-middle-income group. The majority of the bottom five countries were affluent, as they had been categorised as high-income or upper-middle-income groups.

These findings suggest that low-income countries outperformed other OIC countries in terms of the actual score of biodiversity conservation performance.

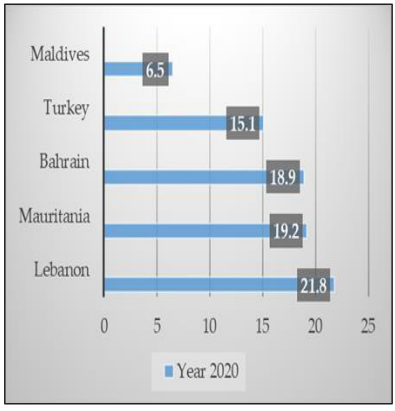
Figure 3(a) and Figure 3 (b)

The Actual Scores of Biodiversity Conservation Performance of the Top Five and Bottom Five OIC Countries in 2020



biodiversity conservation performance

(a)



biodiversity conservation performance

(b)

Learning Lessons from the Biodiversity Policy Successes of Low-Income Countries of the Muslim World

Existing literature suggests that there are two factors contributing to the improvement of biodiversity conservation performance in low-income countries within the OIC. The first factor is international cooperation and financial assistance. This means that international organisations, such as the United Nations (UN) through its organs or international regimes like conventions, collaborate with countries through biodiversity conservation programmes. Essentially, low-income countries can enhance their ability to engage in biodiversity conservation programmes through partnerships and support from

organisations like the UN (Abor, 2023). For example, the Moroccan government has strengthened its legal resources (Law No. 29-05) and joined the international regime on wildlife protection by enforcing the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In the last two decades, the international wildlife regime has provided almost USD 200 billion in funding to the country (Ammari et al., 2022). At the local policy level, the country has implemented stronger legal measures to protect fishery resources and banned the use of gill nets. They have also launched the "Morocco Forests 2020-2030" national strategy, which aims to preserve national forests to prevent desertification and wildfires. The strategy also focuses on safeguarding endangered species of wild plants and animals (Ammari et al., 2022). Similarly, in Uganda, the United Nations Development Programme (UNDP) reported in 2023 that the country has created a regional cooperation framework to protect its forests and wildlife areas, such as the Albertine Rift Eco-Region, with financial support from the Global Environment Facility (GEF). Burkina Faso and Niger have also shown improvement in their biodiversity conservation efforts, thanks to their active participation in international cooperation programmes, particularly with the GEF. These countries have been involved in the African Great Green Wall Initiative project, which has also contributed to their conservation efforts. Through this project, the GEF has provided financial support to the countries, allowing each to design GEF projects based on its national-level priorities for GEF resources (The World Bank, 2011). The practice of farmer-managed natural regeneration has proven to be very beneficial for enhancing biodiversity. Countries like Burkina Faso and Niger have taken advantage of this opportunity to implement initiatives for greening arid lands. As a result, by 2011, there were early signs that farmers who engaged in agroforestry, water, and soil management in these countries had successfully initiated a process of 're-greening'. This process not only stopped desertification but also improved local livelihoods. The experience of farmer-managed natural regeneration has resulted in the transformation of approximately 5 million hectares of land into productive agroforestry systems. According to The World Bank in 2011, these scenarios indicate a positive trend in biodiversity conservation performance among the low-income countries of the OIC. This trend has been facilitated by regional and international efforts, cooperation, and financial assistance.

Incorporating the technique of climate change adaptation into biodiversity conservation programmes is crucial for countries to prepare for the challenges that come with changing climate conditions (Groves et al., 2012). Morocco has taken some initiatives, such as the National Biodiversity Strategy and Action Plan (NBSAP), to address the effects of climate change on biodiversity conservation. The NBSAP plan aligns with the Convention on Biological Diversity (CBD) strategy plan for 2011-2020 and the AICHI target, which includes AICHI Target 15. This target aims to increase ecosystem resilience and the contribution of biodiversity to carbon stocks, thereby mitigating and adapting to climate change as well as combating desertification. The updated National Biodiversity Strategy and Action Plan for 2016-2020 ensures the conservation of Morocco's diverse ecosystems (Nassif & Tanji, 2017). Niger has taken steps to protect its biodiversity by implementing climate change adaptation methods. To prevent desertification and improve resilience to changing climatic conditions, the country has focused on sustainable land management and afforestation programmes (Richardson et al., 2009). In 2016, Niger began its local policy, the Intended Nationally Determined Contributions (INDC), which identifies agriculture, forestry, and land use, as well as energy, as critical areas for development, as these sectors contribute significantly to the country's greenhouse gas (GHG) emissions (UNEP, 2023). The INDC prioritises the implementation of more effective sustainable land management practices as a major mitigation action for biodiversity protection. The plan also gives priority to implementing sustainable forest management to reduce greenhouse gas emissions associated with deforestation (UNEP, 2023).

The results of the present study have underscored the significance of collaborations between scientists and policymakers in developing effective measures for protecting biodiversity. The efforts and initiatives of the countries discussed above serve as examples of how strategic local and international partnerships have led to positive outcomes for biodiversity conservation at the respective nation states in Muslim countries.

DISCUSSION

The present study has discovered some significant findings. Firstly, both affluent and low-income OIC member states had demonstrated

a noticeable improvement in biodiversity conservation performance. Secondly, the highest growth in biodiversity conservation performance scores was observed in low-income countries. Thirdly, there was a decline in biodiversity conservation performance for both affluent and low-income countries, but it was not as substantial as the growth rate. Additionally, most of the countries in the bottom five were affluent countries. Furthermore, low-income countries were leading in terms of the OIC's biodiversity conservation performance. Lastly, low-income OIC countries outperformed other OIC countries in terms of the actual score of biodiversity conservation performance.
The findings of this study show that there is a noticeable increase in the growth of biodiversity conservation management among OIC countries. Interestingly, low-income countries are leading the way in this trend. This suggests that these countries are emerging as leaders in biodiversity conservation management within the OIC. They are competing with more prosperous OIC nations to secure a position among the best in biodiversity conservation performance.

The study's perspective on biodiversity conservation provides valuable insights that complement the Ismail et al. (2019) study on OIC countries. Ismail et al. (2019) provided a broad assessment of environmental performance, whereas this research exclusively focused on biodiversity conservation. Therefore, it adds value to previous studies by demonstrating that not only developed economies, but low-income countries also play a significant role in global environmental performance among OIC countries. Overall, this study's in-depth analysis reveals that low-income countries also play a crucial function in biodiversity conservation management, which was not apparent in previous studies.

Furthermore, the findings of this study lend support to Stern's approach regarding the diverse effects, processes, and outcomes of biodiversity policy decisions in different countries (Stern, 2004). According to Stern, economic growth has various impacts on environmental quality, which challenges the Environmental Kuznet Curve (EKC) hypothesis in this regard. The EKC hypothesis suggests that economic growth initially causes biodiversity loss, but as countries achieve higher economic growth, environmental degradation decreases (Palmer & Di Falco, 2012). However, the present analysis reveals a notable and significant observation: most low-income countries have made substantial strides in their efforts to preserve biodiversity, which questions the validity of the EKC theory. This finding supports those

who oppose the EKC hypothesis. The EKC hypothesis has been a subject of debate and investigation in international environmental politics. Stern (2004) highlights that the theory's application varies depending on the country, region, and environmental issue.

The findings of this study highlight the importance of environmental policy in biodiversity conservation efforts. According to Vogler (2005), stringent environmental regulations and policies are necessary to achieve environmental sustainability. This means that relying solely on economic growth to address environmental concerns is not enough. Decision-makers must find a balance between economic growth and environmental protection in international environmental policymaking. The EKC theory questions the effectiveness of economic development as a solution to environmental problems. This emphasises the importance of well-crafted policies for sustainable development and global environmental protection (Vogler, 2005). For instance, Niger has grappled with challenges such as desertification, land degradation, drought, and biodiversity loss. Conversely, the "Action against Desertification" project actively contributes to the execution of Niger's Great Green Wall (GGW) program. This initiative aims to enhance resilience and productivity in arid regions while fostering economic growth (Goffner et al., 2019). It endeavours to rehabilitate millions of hectares of arid land by 2030, not only within Niger but also in neighbouring Sahelian countries, including Algeria, Burkina Faso, Benin, Chad, Cape Verde, Djibouti, Egypt, Ethiopia, Libya, Mali, Mauritania, Nigeria, Senegal, Somalia, Sudan, The Gambia, and Tunisia (FAO, 2017).

The findings challenge the scepticism of certain authors who believe that Muslim countries are not doing enough to conserve the environment. Zagonari (2023) suggests that the ideals of parsimony and trusteeship in Islam work best in pre-industrial economies, which are common in many Muslim countries, but are not as effective in promoting sustainability in more developed economies. Similarly, Mohammed (2014) notes that although Islam is a significant force in the lives of its followers, scholars have criticised those in power for not adequately addressing the environmental crisis. Yusof (2013) also points out that low-income countries face various domestic challenges, such as insufficient technology, poverty-related issues, and a lack of environmental leadership (Yusof et al., 2013). Similarly, Saniotis (2012) stated, "While Islam provides detailed ethical principles on

the environment, the majority of Muslim-majority countries show apparent indifference to environmental issues' (Saniotis, 2012: 155). However, the findings of this study have questioned the belief that Muslim countries are lagging behind in environmental efforts. Instead they have highlighted the significant progress in biodiversity protection within these nations.

It is important to acknowledge that the beliefs commonly held about Muslim countries and their approach to biodiversity conservation are not necessarily accurate. They do not explain recent conservation behaviour and appears to be contrary to the findings of the present study on conservation performance. In fact, the present study shows that not all Muslim countries exhibit poor environmental protection practices, despite their income diversity. The results indicate that many of these countries such as Morocco, Niger, and Guyana are actively addressing biodiversity issues, which supports the arguments put forth by some scholars that Muslim countries are contributing to environmental stewardship within their territories (Kaminski, 2019). Additionally, Islam places great importance on biodiversity and recognises its crucial role, which has led to the active participation of Muslim countries in biodiversity conservation through Islamic law. This reinforces the likelihood of sustainability transitions in Arab-Islamic countries, as highlighted by Vincenti (2016). The present study's findings support the perspectives of these scholars, demonstrating that Muslim countries are indeed taking steps to protect and conserve the biodiversity of their countries.

The present study has shown that Muslim countries have been making significant efforts towards conserving biodiversity, which can help improve their image in terms of biodiversity governance at the national and global levels. It has also found that most low-income OIC countries have shown growth in their biodiversity conservation performance. Among these countries, Morocco has emerged as the top performer in terms of biodiversity conservation growth during the period of study.

Existing literature recognizes Morocco as an OIC country that places significant importance on biodiversity conservation and the utilization of agricultural biodiversity on farms (Bragdon et al., 2009). The country also implements agroforestry practices that provide several benefits, such as protecting biodiversity, addressing climate change,

improving terrestrial agronomic cost-effectiveness, integrating livestock, and controlling erosion (Daoui & Fatemi, 2014). These practices demonstrate Morocco's commitment to conserving its country's biodiversity, which reflects positively on the OIC, of which it is a member state.

The United Arab Emirates government recognises the crucial role of private companies in protecting the environment. The government has taken steps to create green spaces throughout the country (Alam et al., 2017). For instance, in the early 2000s, the UAE government embarked on a transformation of substantial portions of its desert landscape into flourishing ecosystems, dedicating considerable resources to initiatives such as agricultural development, park creation, and the establishment of nature reserves (Quis, 2002). This initiative gained momentum with the introduction of the 'Green Economy for Sustainable Development,' as the UAE aspired to emerge as a key producer of innovative green technologies (Krzymowski, 2022). Subsequently, the UAE Green Agenda 2015-2030 was launched with the overarching goals of augmenting the country's GDP, enhancing exports, and mitigating the country's carbon emissions (Krzymowski, 2022). Concurrently, the pursuit of green spaces is associated with the overall national agenda that involves the implementation of afforestation and urban landscaping projects across the country (Saxena & Kumar, 2020).

Other OIC countries, especially those with low-income, have demonstrated relatively greater care for their biodiversity. For example, Cote D'Ivoire, Indonesia, and Cameroon have taken measures to protect their wildlife by curbing poaching and hunting activities within their borders (Kablan et al., 2019; Rifaie et al., 2015; Waltert et al., 2002). Azerbaijan, Bangladesh, and Gabon have implemented institutional strategies to conserve biodiversity (Friedlander et al., 2014; Lamine et al., 2020; Mamun et al., 2016; Schmidt et al., 2017). Moreover, the present study has found that enhancing biodiversity conservation performance in low-income countries that are members of the OIC is linked to factors such as global collaboration, financial aid, and the integration of adaptation strategies for climate change. These measures improve the readiness of the OIC member states in tackling the challenges caused by the changing climate conditions.

This study has thus, shown the close relationship between science and policy, proposing a new approach that incorporates historical

biodiversity data from OIC countries. This approach is pertinent to understanding the dynamics between scientists and governments within the policymaking process for biodiversity conservation. Through this approach, natural scientists can work with policymakers to address issues related to biodiversity protection. This collaborative effort involves the mutual exchange of knowledge and ideas that improves decision-making and enhances the score growth trend, thereby enriching the relationships between scientists and other stakeholders in the political process. This approach has been useful in tracking biodiversity loss at national, regional, and global levels. It has also supported several strategies, such as monitoring the state of biodiversity, creating indicators that communicate information on the state of biodiversity, and developing scenarios to assess the potential impacts of different policies (Couvet & Prevot, 2015). Various policy-science statistics have been provided to convey information on the status of biodiversity and develop scenarios to assess the potential effects and trends of different policies and strategies. This research has also addressed issues related to policy initiatives and the roles of governments in biodiversity policy systems, which indirectly contribute to performance scores in terms of biodiversity protection policies. These issues are central to public policy research. Dipak (2011) and Wilder (2017) have discussed these issues extensively.

The present research has focused on policy initiatives related to biodiversity conservation, and the role of governments in implementing these policies. This has indirectly led to improved performance scores in terms of biodiversity conservation policies. These issues are central to international relations and public policy research (Wilder, 2017). Effective biodiversity protection measures require collaborative efforts between scientists and policymakers. The findings of the present study have demonstrated how such interactions can result in positive outcomes for biodiversity conservation at national levels. It has specifically addressed the issue of biodiversity conservation and policy, highlighting the outstanding performance of low-income countries among the OIC member states. These countries, notably Morocco, Niger and Guyana, have achieved impressive scores in biodiversity conservation, contributing significantly to the attainment of Sustainable Development Goals 14 and 15 (SDG 14 and SDG 15). SDG 14 is crucial for conserving the long-term health and sustainability of marine ecosystems, as well as the well-being of both humans and marine life. Meanwhile, achieving SDG 15 is

critical for conserving the Earth's natural diversity and creating a more sustainable and resilient future (Reyers & Selig, 2020).

Although this study has many methodological strengths, it also has some limitations. One of the main concerns was that it had relied on data surveys conducted by Yale University. This dependence had created difficulties in accessing certain archival records, leading to limited comprehensiveness of the data. Additionally, the study's limitations are exacerbated by the unavailability of crucial data sources. However, the data gathering process was objective and thorough, which helped the researcher gain a nuanced understanding of the subject matter.

CONCLUSION

The existing literature suggests that Muslim countries often fall behind in achieving environmental sustainability, even though they comply with global environmental regulations. However, the present study has made a significant contribution as previous studies have overlooked some matters when exploring an area of research within the Muslim world. The evidence presented in this paper highlights the benefits of biodiversity programmes in low-income Muslim countries. Interestingly, this study challenges common assumptions as it reveals that not all environmental characteristics follow the same pattern for Muslim countries. Particularly noteworthy are the recent developments in the biodiversity conservation performance of Muslim nations, which were contrary to the general notion of their lagging behind in this aspect.

The main objective of the research was to investigate the state of biodiversity conservation in the OIC countries and determine whether there has been an improvement in recent years. The findings indicate a notable enhancement in biodiversity protection performance over the ten-year period studied. It is surprising that low-income countries, despite their inferior economic development status, have outperformed richer OIC countries in this regard. This is a positive indication of the effectiveness of the key biodiversity policies and measures implemented in these Muslim countries. These findings also support Stern's approach, which suggests that the effects, procedures, and outcomes of biodiversity policy choices vary between individual

countries. His claims that economic expansion has a range of effects on environmental quality led to the rejection of the Environmental Kuznet Curve hypothesis in this context.

The findings of the study have significant implications. Firstly, they support Stern's arguments about the varying consequences, methods, and outcomes of biodiversity policy decisions in different nations, as well as the unpredictability of environmental policy adoption, in which emerging countries sometimes outperform industrialised ones. Secondly, the study challenges the widely held notion that all Muslim countries fall behind in environmental conservation measures. Thirdly, it highlights the intersection between science and policy. The study's results further reinforce the idea that Muslim countries, despite their differing income levels, are taking aggressive measures to address biodiversity loss. This needs to be recognised and acknowledged globally. Therefore, it is recommended that more research should be conducted on the biodiversity policies of OIC nations that have been instrumental in biodiversity conservation. This research should be effectively integrated into science-policy approaches to assess the strengths, weaknesses, opportunities, and threats to biodiversity policies in OIC nations and provide solutions to restore and evaluate historical ecosystems and natural resource management practices. Lastly, the findings can enhance the OIC's role in helping Muslim countries achieve the SDGs.

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