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### Unrevealing Impediments: Empirical Perspective of Biodiversity Finance Implementation

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|   | <b>Abstract</b>  |
| <p><b>Ayesha Shehzad</b><br/>Institute of Business &amp; Management, University of Engineering and Technology, Lahore, Pakistan<br/>Email: <a href="mailto:ayesha.shahzad878@gmail.com">ayesha.shahzad878@gmail.com</a><br/><a href="https://orcid.org/0000-0002-1570-6116">https://orcid.org/0000-0002-1570-6116</a></p> <p><b>Kanwal Iqbal Khan</b><br/>Assistant Professor, Department of Management Sciences, University of Engineering and Technology, New Campus, Kala Shah Kaku, Pakistan<br/>Corresponding Author Email:<br/><a href="mailto:drkanwaliqbalkhan@gmail.com">drkanwaliqbalkhan@gmail.com</a><br/><a href="https://orcid.org/0000-0003-0316-1670">https://orcid.org/0000-0003-0316-1670</a></p> | <p>Climate change is having a detrimental impact on biodiversity, underscoring the importance of adopting sustainable practices for the conservation and preservation of the biosphere. Sufficient funding is required to halt and reverse biodiversity loss; unfortunately, resource scarcity and limited awareness are hindering the sustainable management of biodiversity, which is crucial for achieving the Sustainable Development Goals (SDGs). Biodiversity finance is the practice of raising and managing funds and ensuring the sustainable management of biodiversity. However, this concept is relatively new and still requires theoretical and empirical understanding. To bridge the gap, this study attempts to address the significance of biodiversity finance from the perspective of the SDGs. It has empirically investigated and compared the impact of multiple factors on the implementation of biodiversity finance systems across developed and developing countries worldwide. A significant link between biodiversity finance and SDGs is presented through study findings. The study will contribute to the body of knowledge by addressing the emerging concept of public biodiversity finance, highlighting its importance and unraveling the adoption obstacles for different countries worldwide.</p> |
| <b>Keywords:</b>  | Biodiversity Finance, Sustainable Development Goals, Climate Change, Sustainable Development, Public Biodiversity Finance  |



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### Introduction

Environmental deregulation is adversely affecting the natural cycle of this ecosystem by harming biodiversity, which is disturbing the natural balance of life and ecosystem processes (Capelle-Blancard & Monjon, 2012). Furthermore, the use of harmful chemicals, deforestation, landslides, floods, erosion, the discharge of untreated sewage water, oil spills, and climate change are contributing to biodiversity loss (Reed, 2016; Yang et al., 2021). Natural disasters, such as earthquakes, tornadoes, floods, fires, and cyclones, also impact our natural environment. Not only natural disasters, but also some serious problems arising from intentional or accidental human activities may challenge natural habitats (Khan & Shehzad, 2025a). Toxic human activities leading to the infertility of land and underwater creatures include nuclear power plant events, accidental toxic spills, terrorist attacks, bombings, poisonings, etc. (Saxena, 2023). Therefore, immediate protection of the ecosystem is necessary to prevent further harm to biodiversity. However, this situation is harming the whole world, specifically the growth and development of developing countries. Where land and aquatic (underwater) biodiversity are major contributors to GDP, approximately 50% of the global GDP (nearly \$40 trillion) is dependent on natural resources. Moreover, around \$250 billion is annually contributed to the developing economies by biodiversity (Borah et al., 2020).

Every sector of a country is directly or indirectly linked to its land productivity, which meets food requirements with good financial returns (Shehzad & Khan, 2024a). On the other hand, increasing soil and water pollution, habitat loss, fishing and hunting, climate change, and disasters are rapidly contributing to biodiversity loss (Singh et al., 2021). These circumstances are raising serious global concerns, specifically for countries where biodiversity directly contributes to economic well-being. Immediate precautions are required at the international level to prevent biodiversity loss. Immediate preservation of biodiversity is recommended to conserve nature, ensure food production, protect nutrients, and promote economic well-being (Shehzad et al., 2025). Sustainable land protection enhances the soil's resilience to environmental changes, provides essential nutrients for crop productivity, and encourages the growth of living organisms (Edmans & Kacperczyk, 2022). Similarly, the protection of aquatic and marine life improves the health of oceans and the whole planet (Dudgeon et al., 2006).

It is essential for maintaining global oxygen levels, producing seafood, controlling pollution, and ensuring a healthy Earth (Bhandary et al., 2021). The sustainable management and conservation of biodiversity are required, but unfortunately, due to resource scarcity, this practice is hindered in emerging economies like Pakistan. A lack of funding opportunities impedes the adoption of sustainable biodiversity preservation practices, which will directly prevent future biodiversity loss. Therefore, all these triggering situations have raised the question of how biodiversity protection is attained under the Sustainable Development Goals (SDGs). This question is crucial for designing effective financial strategies to meet the financing requirements for achieving the SDGs.

In December 2022, the Kunming-Montreal Global Biodiversity Framework (GBD) was embraced by 196 countries at the Convention on Biological Diversity. This framework calls for collaboration and collective effort to achieve a breakthrough, aiming to halt and reverse biodiversity loss by 2030 (CBD, 2022). Biodiversity finance flows comprise both private and public financial resources (Karolyi & Tobin-de la Puente, 2023). According to Cuming (2023), biodiversity finance flows currently amount to approximately \$166 billion each year, with the government sector making significant contributions. However, actual biodiversity conservation funds of \$996 billion are required until 2030. Therefore, there is an \$830 billion financing gap between current spending and 2030 requirements, which requires the immediate scaling up of biodiversity finance to cover this gap. The increase in biodiversity finance can only be possible if governments, companies, and financial institutions integrate biodiversity into their planning, policies, risk assessments, and investments (Shehzad & Khan, 2024).

This situation requires a collective effort from both the government and the private sector. Governments need to identify and eliminate damaging subsidies, utilizing them instead for environmentally friendly purposes (OECD, 2020). Moreover, proper motivation is required to ensure the protection of nature. Similarly, private entities should view this as an opportunity and collaborate in promoting biodiversity protection plans. Government spending plays a significant role, contributing approximately \$126 billion (or 76% of the finance flows) to protect biodiversity. Along with this, only \$29 billion (which is around 17%) is being contributed by private finance flows; this includes impact investment (\$5 billion), offsets (\$6 billion), sustainable supply chain finance (\$8.1 billion), and payments for ecosystem services (\$9.9 billion). The remaining \$6 billion is contributed by overseas assistance (4%), and green finance contributes around \$5 billion, which is only 3% of the total contribution (Cuming, 2023). Therefore, immediate action is required to address the \$830 billion biodiversity finance gap by 2030. Biodiversity finance provides the funds needed to support sustainable biodiversity management; however, no proper research is being conducted on this emerging concept (Khan & Shehzad, 2024).

The concept of biodiversity finance is relatively new, with a limited number of studies focusing on it (Karolyi & Tobin-de la Puente, 2023). Prior studies have focused on its basic conceptualization and primary measurements (Anyango-van Zwieteren, 2021; Chaudhary et al., 2022; Cosma et al., 2023a). However, it still requires theoretical and

empirical explanations. Moreover, this study is one of the primary studies to provide an estimate of public biodiversity finance implementation in developed and developing countries worldwide. It will also provide a detailed comparison between developed and developing countries, highlighting their worldwide discrepancies.

### Literature Review

As the world evolves rapidly, every country is competing to join the ranks of industrialized economies. Unfortunately, many countries are lagging and are considered underdeveloped or least developed economies (Khan & Shehzad, 2025a). Most underdeveloped nations lack effective research and development techniques, resulting in outdated production systems that lead to numerous environmental, social, and economic problems. This situation leads to biodiversity loss, which refers to the decline of biological diversity (Andres et al., 2023). Climate change, arising from global warming and changes in precipitation, is one of the greatest threats to biodiversity loss (Wudu et al., 2023). Due to the limited funding available in emerging economies, scarce resources are allocated to address the issue of biodiversity loss and ensure biological preservation (Gehricke et al., 2023). The need for increased capital investment to support the well-being of biodiversity is being highlighted on various forums, as there is an emerging demand for the latest strategies required to achieve the 17 SDGs by 2030 (Cosma et al., 2023b). Proper financial support is needed to implement green practices. This requirement is fulfilled through biodiversity finance, which utilizes financial incentives to ensure the sustainable management of biodiversity (Feliciano, 2022; Wang et al., 2021).

The global economy, to some extent, is dependent on nature and its resources. The World Economic Forum and the United Nations Environment Programme have declared that approximately 50% of the world's GDP is based on nature and its resources (Rasheed et al., 2021). Unfortunately, nature and its natural reserves are being harmed by multiple human activities at an alarming rate; therefore, sustainability is crucial for the preservation and conservation of nature and its resources, including water, air, and land. Sustainability encompasses environmental, social, and economic perspectives, and all these essentials are interconnected with humans, the planet, purpose, and profits (Khan & Shehzad, 2025b). Many sustainable financing techniques and tools are being focused on by investors, ensuring both economic and monetary returns (Schumacher et al., 2020). Sustainable investment is an emerging opportunity considering environmental, social, and governance factors. Furthermore, the emerging concept of biodiversity finance was presented by (2023) as the practice of raising and managing capital, and using financial incentives to ensure the sustainable management of biodiversity and the natural environment.

### Materials and Methods

#### Gaps in Public Biodiversity Finance Measures

Biodiversity finance includes the flow of funds and expenditures made to protect biodiversity and natural ecosystems. Cuming (2023) argued that biodiversity finance flows include 76% of public domestic, 4% of public international, 17% of private, and 3% of other biodiversity financial flows. Although the practice of biodiversity finance is gradually becoming common, the proportion of funds flowing is still very low compared to the required capital ( Duanmu et al., 2021). Therefore, a massive amount of both public and private biodiversity finance is required to cover the biodiversity financing gap (Shehzad & Khan, 2024b). The emerging concept of biodiversity finance is introduced in nature; prior authors have focused on its basic conceptualization and measures. Still, there is a lack of studies presenting the factors that affect the flow of biodiversity finance. The data related to the flow of capital towards biodiversity protection is still missing. Some sources, including the UNDP, BIOFIN, and Bloomberg, have presented data. The available data still lack consistency and are insufficient to conduct a comprehensive empirical study related to biodiversity finance.

#### Measurement

Biodiversity finance refers to the combination of public and private finance flows used to protect and restore biodiversity. The financial flows from both sources are equally essential to halt biodiversity loss. Although the presence of private finance flows is necessary, the proportion of public biodiversity finance flows is considered significant to protect the natural environment and its' living creatures. Therefore, this study has utilized panel data from multiple countries, using the following data sources: the World Bank, the IMF, and Bloomberg, among others. Based on availability, data were collected for 51 countries from 2015 to 2023, comprising 20 developed and 31 developing countries worldwide. The objective of this study is to predict public biodiversity finance flows for both developed and developing countries worldwide. Therefore, the data related to the expenditure on biodiversity was collected from the IMF in terms of the percentage of GDP. A linear regression model was used, with public biodiversity finance as the dependent variable. For this, data related to expenditure on biodiversity and landscape were analyzed using R Studio. The model has estimated the impact of key factors on public biodiversity finance flows for developed and developing countries worldwide, using Equation 1.

$$BDF = \alpha_0 + gdp_{it}\alpha_1 + tep_{it}\alpha_2 + tp_{it}\alpha_3 + pol\alpha_4 + cs_{it}\alpha_5 + pov_{it}\alpha_6 + pa_{it}\alpha_7 + ub_{it}\alpha_8 + uecs_{it}\alpha_9 + \varepsilon_{it} \quad (1)$$

$BDF$  is public biodiversity finance in terms of % of GDP for country  $i$  in  $t$  years,  $\alpha$  is the constant,  $gdp$  presents the annual % growth in GDP,  $tep$  is the total endangered species and is the number of species which are with an extinction threat probability of 80 or more,  $tp$  presents the total number of species,  $pol$  is the level of pollution rate and is defined as the population to concentrations of suspended particles, it is presented in terms of cubic meters,  $cs$  is the country size,  $pov$  is poverty,  $pa$  is the representation of protected areas,  $ub$  is urbanization, and  $ue$  is unemployment.

$$BDF_{DC} = \beta_0 + gdp_{it}\beta_1 + tep_{it}\beta_2 + tp_{it}\beta_3 + pol\beta_4 + cs_{it}\beta_5 + pov_{it}\beta_6 + pa_{it}\beta_7 + ub_{it}\beta_8 + uecs_{it}\beta_9 + \varepsilon_{it} \quad (2)$$

$$BDF_{UDC} = \gamma_0 + gdp_{it}\gamma_1 + tep_{it}\gamma_2 + tp_{it}\gamma_3 + pol\gamma_4 + cs_{it}\gamma_5 + pov_{it}\gamma_6 + pa_{it}\gamma_7 + ub_{it}\gamma_8 + uecs_{it}\gamma_9 + \varepsilon_{it} \quad (3)$$

Moreover, the present study has employed a panel data approach for 51 countries worldwide from 2015 to 2023. A linear regression model was selected for the present study. Furthermore, after performing the analysis, the comparison of the results between developed and developing countries was conducted through Equations (2) and (3) to explain the worldwide differences. Equation 2 estimates the impact of factors on public biodiversity finance for developed countries, and Equation 3 measures public biodiversity finance in the context of developing countries. Furthermore, a linear regression model was used to analyze the factors impacting the public biodiversity finance implementation system.

**Table 1: Statistical Description for Global Factors**

| Factor                                 | Mean       | SD         | Median    | MIN    | MAX         | N   |
|--|------------|------------|-----------|--------|-------------|-----|
| Public biodiversity finance (%)        | 0.06       | 0.06       | 0.05      | 0.00   | 0.32        | 459 |
| GDP growth (%)                         | 2.79       | 4.38       | 3.02      | -28.76 | 24.62       | 459 |
| Endangered species                     | 829.69     | 1058.27    | 438.00    | 43.00  | 5540.00     | 459 |
| Total species                          | 25506.96   | 20380.59   | 18891.00  | 725.00 | 88726.00    | 459 |
| Pollution ( $\mu\text{g}/\text{m}^3$ ) | 18.10      | 10.58      | 17.08     | 4.90   | 71.87       | 459 |
| Country size ( $\text{km}^2$ )         | 1303760.44 | 3118435.40 | 241930.00 | 198.00 | 16376870.00 | 459 |
| Poverty (%)                            | 18.55      | 9.28       | 16.00     | 1.60   | 60.00       | 459 |
| Protected area (%)                     | 17.30      | 11.78      | 15.04     | 0.00   | 55.80       | 459 |
| Urbanization (%)                       | 67.32      | 20.92      | 68.78     | 18.26  | 100.00      | 459 |
| Unemployment (%)                       | 6.27       | 4.08       | 5.20      | 0.12   | 23.35       | 459 |

### Analysis and Results

#### Descriptive Statistics

The sample of the study comprises data from various countries worldwide, for which panel data analysis was performed using multiple codes in R Studio. Initially, missing values were checked to prevent any errors or problems when interpreting the results. The codes were executed three times: initially for the complete set to obtain the global representation of the impact of the factors on public biodiversity finance, and later for developed and developing countries separately to facilitate a more significant comparison between them. Therefore, Table 1 presents a detailed summary of the descriptive statistics for global public biodiversity finance. The results display the mean, standard deviation, median, minimum, and maximum values of the data, along with N, representing the number of observations. The mean value of 0.06 for public biodiversity finance indicates that out of the sample of 51 countries, only 6% of the countries have public biodiversity finance flows.

**Table 2: Statistical Description of Factors for Developed Countries**

| Factor                                 | Mean      | SD         | Median   | MIN     | MAX        | N   |
|--|-----------|------------|----------|---------|------------|-----|
| Public biodiversity finance (%)        | 0.09      | 0.07       | 0.08     | 0.00    | 0.32       | 180 |
| GDP growth (%)                         | 2.43      | 3.65       | 2.26     | -10.30  | 24.62      | 180 |
| Endangered species                     | 1200.85   | 1290.38    | 845.00   | 69.00   | 5540.00    | 180 |
| Total species                          | 37726.30  | 22301.64   | 41388.00 | 2925.00 | 88726.00   | 180 |
| Pollution ( $\mu\text{g}/\text{m}^3$ ) | 11.43     | 8.10       | 9.73     | 4.90    | 48.35      | 180 |
| Country size ( $\text{km}^2$ )         | 976989.59 | 2462208.26 | 91385.00 | 198.00  | 8965590.00 | 180 |

|                    |       |       |       |       |        |     |
|--------------------|-------|-------|-------|-------|--------|-----|
| Poverty (%)        | 12.46 | 3.49  | 13.20 | 3.90  | 18.60  | 180 |
| Protected area (%) | 19.46 | 12.84 | 16.25 | 2.30  | 55.80  | 180 |
| Urbanization (%)   | 84.49 | 10.08 | 86.29 | 57.72 | 100.00 | 180 |
| Unemployment (%)   | 5.24  | 1.76  | 4.97  | 1.64  | 10.35  | 180 |

Furthermore, the statistical description of public biodiversity finance flows from the perspective of developed countries is presented through Table 2. The derived results demonstrate that almost 9% of the developed countries are practicing public biodiversity finance. The urbanization rate in the sample of developed countries has a mean value of 84%, with a minimum value of 57% and a maximum value of 100%. Table 3 presents that only 5% of the developing countries are practicing public biodiversity finance. Furthermore, poverty, which is measured by head count ratios at national levels and presented as a percentage of the population, has a minimum value of 1.60% and a maximum value of 60%.

**Table 3: Statistical Description of Factors for Developing Countries**

| Factor                                 | Mean       | SD         | Median    | MIN     | MAX         | N   |
|--|------------|------------|-----------|---------|-------------|-----|
| Public biodiversity finance (%)        | 0.05       | 0.06       | 0.03      | 0.00    | 0.27        | 279 |
| GDP growth (%)                         | 3.02       | 4.79       | 3.80      | -28.76  | 16.47       | 279 |
| Endangered species                     | 590.23     | 791.32     | 204.00    | 43.00   | 3031.00     | 279 |
| Total species                          | 17623.52   | 14318.46   | 11566.00  | 725.00  | 59191.00    | 279 |
| Pollution ( $\mu\text{g}/\text{m}^3$ ) | 22.41      | 9.74       | 20.17     | 8.99    | 71.87       | 279 |
| Country size ( $\text{km}^2$ )         | 1514580.34 | 3464663.53 | 273600.00 | 1997.00 | 16376870.00 | 279 |
| Poverty (%)                            | 22.48      | 9.72       | 22.50     | 1.60    | 60.00       | 279 |
| Protected area (%)                     | 15.91      | 10.83      | 14.70     | 0.00    | 41.30       | 279 |
| Urbanization (%)                       | 56.24      | 18.49      | 57.99     | 18.26   | 88.01       | 279 |
| Unemployment (%)                       | 6.94       | 4.93       | 5.50      | 0.12    | 23.35       | 279 |

### Linear Regression

A linear regression model was performed three times to conduct a cross-country comparison of the implementation of public biodiversity finance flows. Table 4 presents the results of the linear regression model, which shows the relationship between key factors and public biodiversity finance from global, developed, and developing country perspectives.

**Table 4: Linear Regression of the Key Factors of Public Biodiversity Finance**

| Variable           | Global         |             | Developed      |             | Developing      |             |
|--------------------|----------------|-------------|----------------|-------------|-----------------|-------------|
|                    | B              | S.E         | B              | S.E         | B               | S.E         |
| Intercept          | 0.13850000***  | 0.018270000 | 0.312900000*** | 0.049580000 | 0.137900000***  | 0.018110000 |
| GDP growth         | 0.000510000**  | 0.000637800 | 0.000473300**  | 0.001019000 | 0.000433300**   | 0.000643900 |
| Endangered species | 0.000035340*** | 0.000004865 | 0.000076680*** | 0.000007383 | 0.000043740***  | 0.000008322 |
| Total species      | 0.000001843*** | 0.000000280 | 0.000003890*** | 0.000000378 | 0.000002331***  | 0.000000580 |
| Pollution          | 0.001625000*** | 0.000321700 | 0.002982000*** | 0.000510700 | 0.000823500*    | 0.000336200 |
| Country size       | 0.000000002*   | 0.000000001 | 0.000000016*** | 0.000000003 | 0.000000002***  | 0.000000001 |
| Poverty            | -0.001290000   | 0.000372400 | -0.009320000   | 0.001397000 | -0.000050680*** | 0.000354400 |

|                |               |             |                |             |                |             |
|----------------|---------------|-------------|----------------|-------------|----------------|-------------|
| Protected area | 0.000064150** | 0.000263900 | 0.001762000*** | 0.000350700 | 0.001029000**  | 0.000311900 |
| Urbanization   | 0.000045170   | 0.000173200 | 0.000102000    | 0.000397200 | 0.001028000*** | 0.000227200 |
| Unemployment   | -0.000812500  | 0.000689600 | -0.008857000** | 0.002670000 | -0.001878000** | 0.000684300 |

\*\*\* $p \leq 0.001$ , \*\* $0.001 < p \leq 0.01$ , \* $0.01 < p \leq 0.05$

The results of the linear regression for global public biodiversity finance indicate that GDP growth has a positive and significant value, suggesting that with every one-unit increase in GDP growth, public biodiversity implementation increases by 0.00051 units. Therefore, the results of the study indicate that GDP growth and biodiversity finance implementation are positively correlated with each other. The study findings of Shehzad and Khan (2024b) also support the study's findings, presenting a weak economic situation as a significant hindrance to the implementation of sustainable investment practices. Furthermore, the findings reveal a negative relationship between poverty and employment, suggesting that as the poverty ratio increases, individuals have less capital to invest in sustainable finance opportunities, such as biodiversity finance. From the perspectives of both developed and developing countries, factors such as the number of endangered species, total species, country size, and protected areas have a positive and significant relationship with the implementation of public biodiversity finance systems. Moreover, to enhance the representation of the study findings, Figure 1 visually presents the linear regression models for the key factors impacting the implementation of public biodiversity finance. Public biodiversity finance is plotted on the y-axis, with multiple factors on the x-axis, and the blue line represents the linear regression fit. Moreover, the upward and downward regression line slopes present the positive and negative relationships of the factors, respectively.

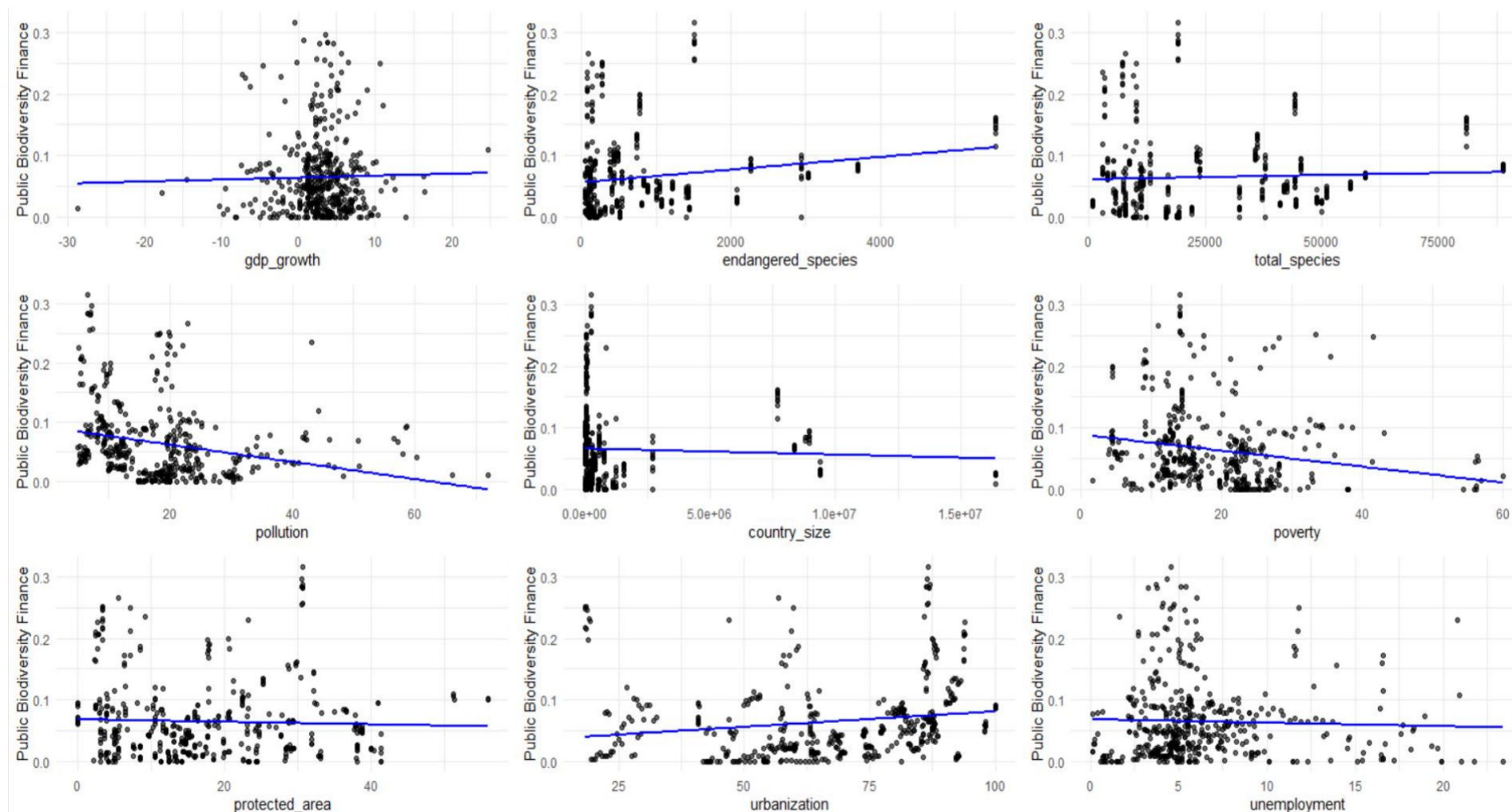
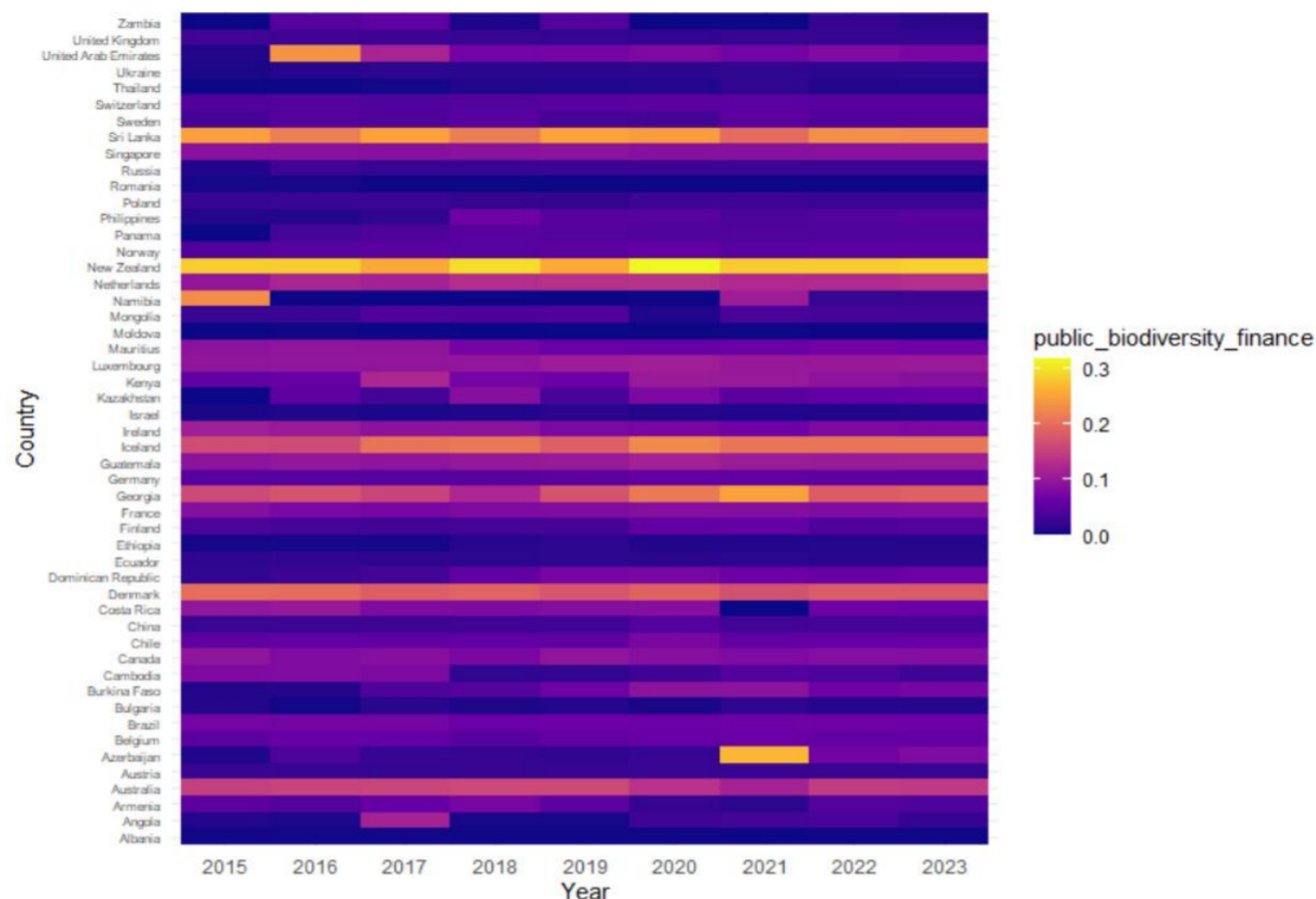


Figure 1: Screen Plots Presenting Linear Regression Models for Key Factors

Furthermore, a heat map of public biodiversity finance across multiple countries is presented in Figure 2. Different colors represent the level of implementation of public biodiversity finance, where yellow indicates the highest level of implementation and purple indicates the lowest level of implementation, according to the scale values (0.0-0.3). It can be observed that most countries have low public biodiversity finance, while only a few countries show higher sustainability investments.



**Figure 2: Visualization of the Heat-map of Public Biodiversity Finance**

The correlation among the key factors of the public biodiversity finance is presented in Table 5. Value 1 presents a perfect positive correlation among the factors, indicating that as one factor increases, the related factor also increases in value. 0 represents the non-linear correlation, and -1 represents a negative correlation, where factors are negatively related; the increase of one factor will decrease the other.

**Table 5: Correlation Matrix Presenting the Relation among the Key Factors**

|                    | PBF   | GDP growth | Endangered species | Total species | Pollution | Country size | Poverty | Protected area | Urbanization | Unemployment |
|--------------------|-------|------------|--------------------|---------------|-----------|--------------|---------|----------------|--------------|--------------|
| PBF                | 1     | 0.02       | 0.17               | 0.04          | -0.24     | -0.05        | -0.19   | -0.04          | 0.16         | -0.04        |
| GDP growth         | 0.02  | 1          | -0.08              | -0.14         | 0.15      | -0.05        | 0.08    | -0.02          | -0.14        | -0.12        |
| Endangered species | 0.17  | -0.08      | 1                  | 0.83          | -0.33     | 0.48         | -0.2    | 0.23           | 0.36         | 0.05         |
| Total species      | 0.04  | -0.14      | 0.83               | 1             | -0.47     | 0.43         | -0.33   | 0.29           | 0.44         | -0.01        |
| Pollution          | -0.24 | 0.15       | -0.33              | -0.47         | 1         | -0.03        | 0.32    | -0.03          | -0.46        | -0.01        |
| Country size       | -0.05 | -0.05      | 0.48               | 0.43          | -0.03     | 1            | -0.18   | -0.04          | 0.11         | 0.01         |
| Poverty            | -0.19 | -0.08      | -0.2               | -0.33         | 0.32      | -0.18        | 1       | 0.15           | -0.5         | 0.1          |

|            |                    |       |       |       |       |       |       |       |       |       |       |
|------------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | Protected area     | -0.04 | -0.02 | 0.23  | 0.29  | -0.03 | -0.04 | 0.15  | 1     | 0.16  | -0.01 |
|            | Urbanization       | 0.16  | -0.14 | 0.36  | 0.44  | -0.46 | 0.11  | -0.5  | 0.16  | 1     | 0.09  |
|            | Unemployment       | -0.04 | -0.12 | 0.05  | -0.01 | -0.01 | 0.01  | 0.1   | -0.01 | 0.09  | 1     |
|            | PBF                | 1     | 0.07  | 0.14  | -0.16 | -0.16 | 0.11  | -0.19 | 0.06  | 0.26  | -0.15 |
|            | GDP growth         | 0.07  | 1     | -0.12 | -0.2  | 0.07  | -0.05 | -0.04 | -0.2  | -0.08 | -0.01 |
|            | Endangered species | 0.14  | -0.12 | 1     | 0.8   | -0.29 | 0.69  | 0.05  | 0.34  | -0.1  | 0.34  |
|            | Total species      | -0.16 | -0.2  | 0.8   | 1     | -0.42 | 0.4   | 0.04  | 0.5   | -0.25 | 0.5   |
| Developed  | Pollution          | -0.16 | 0.07  | -0.29 | -0.42 | 1     | -0.19 | 0.2   | -0.07 | 0.12  | -0.43 |
|            | Country size       | 0.11  | -0.05 | 0.69  | 0.4   | -0.19 | 1     | -0.32 | -0.01 | -0.04 | 0.16  |
|            | Poverty            | -0.19 | -0.04 | 0.05  | 0.04  | 0.2   | -0.32 | 1     | 0.29  | -0.2  | -0.29 |
|            | Protected area     | 0.06  | -0.2  | 0.34  | 0.5   | -0.07 | -0.01 | 0.29  | 1     | -0.08 | 0.06  |
|            | Urbanization       | 0.26  | -0.08 | -0.1  | -0.25 | 0.12  | -0.04 | -0.2  | -0.08 | 1     | -0.15 |
|            | Unemployment       | -0.15 | -0.01 | 0.34  | 0.5   | -0.43 | 0.16  | -0.29 | 0.06  | -0.15 | 1     |
|            | PBF                | 1     | 0.03  | 0.02  | -0.11 | -0.07 | -0.1  | 0.02  | -0.24 | -0.21 | 0.09  |
|            | GDP growth         | 0.03  | 1     | -0.03 | -0.07 | 0.17  | -0.06 | 0.08  | 0.1   | -0.14 | -0.17 |
|            | Endangered species | 0.02  | -0.03 | 1     | 0.86  | -0.19 | 0.48  | -0.14 | 0.03  | 0.5   | 0.06  |
|            | Total species      | -0.11 | -0.07 | 0.86  | 1     | -0.22 | 0.71  | -0.18 | -0.03 | 0.47  | -0.02 |
| Developing | Pollution          | -0.07 | 0.17  | -0.19 | -0.22 | 1     | -0.05 | 0.06  | 0.13  | -0.29 | -0.09 |
|            | Country size       | -0.1  | -0.06 | 0.48  | 0.71  | -0.05 | 1     | -0.27 | -0.04 | 0.29  | -0.03 |
|            | Poverty            | 0.02  | -0.08 | -0.14 | -0.18 | 0.06  | -0.27 | 1     | 0.32  | -0.25 | 0.01  |
|            | Protected area     | -0.24 | 0.1   | 0.03  | -0.03 | 0.13  | -0.04 | 0.32  | 1     | 0.16  | 0.02  |
|            | Urbanization       | -0.21 | -0.14 | 0.5   | 0.47  | -0.29 | 0.29  | -0.25 | 0.16  | 1     | 0.37  |
|            | Unemployment       | 0.09  | -0.17 | 0.06  | -0.02 | -0.09 | -0.03 | 0.01  | 0.02  | 0.37  | 1     |

### Conclusions

Deregulating the environment is causing a rapidly increasing and severely harmful impact on life on Earth. Climate change, pollution, invasive species, habitat loss, and many other issues pose significant threats to biodiversity. Additionally, land depletion has a significant negative impact on the ecosystem, particularly on land productivity. Infertility leads to several problems, including disruptions in ecosystem cycles and the extinction of species. Therefore, adequate funding is essential to support sustainable biodiversity



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management and promote environmental sustainability, ultimately helping achieve the SDGs. The emerging concept of biodiversity finance has been introduced in the literature, but still needs proper acknowledgment and research to be effectively implemented in the future. Biodiversity finance involves the flow of both public and private funds. The key findings of the study revealed that endangered species and total species are the most significant factors, exhibiting a positive and significant relationship at all three levels (global, developing, and developed countries). Urbanization has a significant relationship only from the perspective of developing countries and is a major factor for developed countries. Therefore, this study enhances the existing body of knowledge on public biodiversity finance by offering a basic conceptual framework and related theories, as well as exploring the needs and importance of biodiversity finance in achieving the SDGs of Agenda 2030.

### Study Implications

The present study is one of the primary studies presenting the impact of multiple factors on the public biodiversity finance implementation system. Moreover, the study has also provided a cross-country comparison to understand the country-wise implementation of sustainable investment systems. The study has implications for a wide range of stakeholders, including scholars, investors, financial institutions, and policymakers. First, the findings can be utilized to deepen their understanding of and expand the concept of biodiversity finance, particularly public biodiversity finance. Second, the financial managers and investors can draw assistance from this study when making their investment decisions, taking into consideration the concepts of sustainability and biodiversity protection. Third, the policymakers can draw on the study to make amendments to their existing policies and develop future policies that prioritize sustainability as a significant concern.

### Limitations and Future Directions

The study has also faced some difficulties during its successful completion, as the data available to accurately estimate public biodiversity finance is minimal. First, the data related to financial flows towards biodiversity protection has a significant issue of inconsistency and transparency. The available data is only in the form of the total amount. There is a need for quantitative data on biodiversity finance expenditures by individual categorizations, such as government budgets, private, and NGOs. Second, the total data on estimated finance flows is available, but there is still a need for supplementary information on the methods used to calculate those finance flows. Moreover, in the future, there can be a proper distinction between expenditures allocated to ensure the sustainable management and conservation of biodiversity, which ultimately leads to the accomplishment of the SDGs.

Third, there should be an internationally harmonized approach to assessing and tracking data related to biodiversity finance. A common framework should be established to track the flow of funds directed towards biodiversity finance. Lastly, in the future, proper measures should be developed to evaluate the effectiveness of biodiversity finance flows. Hence, the study has opened up multiple dimensions for exploring the concept of biodiversity finance. This research contribution focuses extensively on biodiversity finance, limiting its comparison to other related concepts, including green bonds, sustainable finance, and impact bonds. This practice will further assist in fully conceptualizing biodiversity finance.

### References

- Andres, S. E., Standish, R. J., Lieurance, P. E., Mills, C. H., Harper, R. J., Butler, D. W., Adams, V. M., Lehmann, C., Tetu, S. G., Cuneo, P., Offord, C. A., & Gallagher, R. V. (2023). Defining biodiverse reforestation: Why it matters for climate change mitigation and biodiversity. *Plants, People, Planet*, 5(1), 27–38. <https://doi.org/10.1002/ppp3.10329>
- Bhandary, R. R., Gallagher, K. S., & Zhang, F. (2021). Climate finance policy in practice: a review of the evidence. *Climate Policy*, 21(4), 529–545. <https://doi.org/10.1080/14693062.2020.1871313>
- Borah, J. R., Laumonier, Y., Rc Bayala, E., Djoudi, H., Gumbo, D., Moombe, K. B., Yuliani, E. L., & Zida, M. (2020). *The role of biodiversity in integrated landscape approaches*.
- Capelle-Blancard, G., & Monjon, S. (2012). Trends in the literature on socially responsible investment: Looking for the keys under the lamppost. *Business Ethics*, 21(3), 239–250. <https://doi.org/10.1111/j.1467-8608.2012.01658.x>
- CBD. (2022). *Convention on Biological Diversity. COP 15: Nations adopt four goals, 23 targets for 2030 in Landmark UN Biodiversity Agreement*. <https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022>
- Chaudhary, A. K., Pandit, R., & Burton, M. (2022). Effect of socioeconomic and institutional factors and sustainable land management practices on soil fertility in smallholder farms in the Mahottari District, Nepal. *Land Degradation & Development*, 33(2), 269–281. <https://doi.org/10.1002/ldr.4143>



# Advance Journal of Econometrics and Finance

## Vol-3, Issue-3, 2025

- Cosma, S., Rimo, G., & Cosma, S. (2023a). Conservation finance: What are we not doing? A review and research agenda. *Journal of Environmental Management*, 336(2), 117649. <https://doi.org/10.1016/j.jenvman.2023.117649>
- Cuming, V. (2023). *Biodiversity Finance Factbook*. 4, 69. [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://assets.bbhub.io/professional/sites/24/REPORT\\_Biodiversity\\_Finance\\_Factbook\\_master\\_230321.pdf](https://assets.bbhub.io/professional/sites/24/REPORT_Biodiversity_Finance_Factbook_master_230321.pdf)
- Duanmu, J., Huang, Q., Li, Y., & McBrayer, G. A. (2021). Can hedge funds benefit from corporate social responsibility investment? *Financial Review*, 56(2), 251–278. <https://doi.org/10.1111/fire.12261>
- Dudgeon, D., Arthington, A. H., Gessner, M. O., Kawabata, Z. I., Knowler, D. J., L ev eque, C., Naiman, R. J., Prieur-Richard, A. H., Soto, D., Stiassny, M. L. J., & Sullivan, C. A. (2006). Freshwater biodiversity: Importance, threats, status and conservation challenges. *Biological Reviews of the Cambridge Philosophical Society*, 81(2), 163–182. <https://doi.org/10.1017/S1464793105006950>
- Edmans, A., & Kacperczyk, M. (2022). Sustainable Finance. *Review of Finance*, 26(6), 1309–1313. <https://doi.org/10.1093/rof/rfac069>
- Feliciano, D. (2022). Factors influencing the adoption of sustainable agricultural practices: the case of seven horticultural farms in the United Kingdom. *Scottish Geographical Journal*, 138(3–4), 291–320. <https://doi.org/10.1080/14702541.2022.2151041>
- Gehricke, S. A., Ruan, X., & Zhang, J. E. (2023). Doing well while doing good: ESG ratings and corporate bond returns. *Applied Economics*, 56(16), 1916–1934. <https://doi.org/10.1080/00036846.2023.2178624>
- Karolyi, G. A., & Tobin-de la Puente, J. (2023). Biodiversity finance: A call for research into financing nature. *Financial Management*, 52(2), 231–251. <https://doi.org/10.1111/fima.12417>
- Khan, K. I., & Shehzad, A. (2024). Unveiling the complexities: An ISM approach to understanding the challenges in biodiversity finance adoption. *Pakistan Journal of Economic Studies*, 7(4), 363–383. <https://journals.iub.edu.pk/index.php/pjes/article/view/3166>
- Khan, K. I., & Shehzad, A. (2025a). Investing in Nature: A Bibliometric Analysis of Biodiversity Finance and Its Contribution to SDGs 14 and 15. *Sustainable Development*, 1–22. <https://doi.org/10.1002/sd.3416>
- Khan, K. I., & Shehzad, A. (2025b). Unlocking investment potential in agriculture: An ISM-based challenge analysis. *Pakistan Business Review*, 26(4), 383–404. <https://doi.org/10.22555/pbr.v26i4.1307>
- OECD (2020), “A comprehensive overview of global biodiversity finance”, OECD Environment Policy Papers, No. 47, OECD Publishing, Paris, <https://doi.org/10.1787/25f9919e-en>.
- Reed, D. H. (2016). Impact of climate change on biodiversity. *Handbook of Climate Change Mitigation and Adaptation, Second Edition*, 1(1), 595–620. [https://doi.org/10.1007/978-3-319-14409-2\\_15](https://doi.org/10.1007/978-3-319-14409-2_15)
- Saxena, A. (2023). Deteriorating environmental quality with special reference to war and its impact on climate change. *National Academy of Science Letters*, 47, 447–450. <https://doi.org/10.1007/s40009-023-01279-y>.
- Schumacher, K., Chenet, H., & Volz, U. (2020). Sustainable finance in Japan. *Journal of Sustainable Finance and Investment*, 10(2), 213–246. <https://doi.org/10.1080/20430795.2020.1735219>
- Seidl, A., Mulungu, K., Arlaud, M., van den Heuvel, O., & Riva, M. (2020). Finance for nature: A global estimate of public biodiversity investments. *Ecosystem Services*, 46, 101216. <https://doi.org/10.1016/j.ecoser.2020.101216>
- Shehzad, A., & Khan, K. I. (2024a). Impediments to biodiversity finance implementation system: A thematic analysis. *Pakistan Journal of Commerce and Social Sciences*, 18(4), 925–960.
- Shehzad, A., & Khan, K. I. (2024b). Time traveling through research : Bibliometric analysis of biodiversity finance in agricultural sector for SDGs. *Journal of Agriculture and Food Research*, 18(10), 101485. <https://doi.org/10.1016/j.jafr.2024.101485>
- Shehzad, A., Khan, K. I., & Mahmood, S. (2025). Complexity of adoption : An ISM model of impediments for social responsibility investment in Pakistan. *Journal of Management and Administrative Sciences*, 5(1), 1–19.
- Singh V, Shukla S, Singh A (2021). The principal factors responsible for biodiversity loss. *Open Journal of Plant Science* 6(1), 11-14. <https://dx.doi.org/10.17352/jps.000026>
- Wang, H., Zhong, S., Guo, J., & Fu, Y. (2021). Factors affecting green agricultural production financing behavior in Heilongjiang family farms: A structural equation modeling



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approach. *Frontiers in Psychology*, 1. <https://doi.org/10.3389/fpsyg.2021.692140>

Wudu, K., Abegaz, A., Ayele, L., & Ybabe, M. (2023). The impacts of climate change on biodiversity loss and its remedial measures using nature based conservation approach: a global perspective. *Biodiversity and Conservation*, 32(12), 3681–3701. <https://doi.org/10.1007/s10531-023-02656-1>

Yang, Q., Liu, G., Casazza, M., Gonella, F., & Yang, Z. (2021). Three dimensions of biodiversity: New perspectives and methods. *Ecological Indicators*, 130, 108099. <https://doi.org/10.1016/j.ecolind.2021.108099>