The impact of climate change and energy resources on biodiversity loss: Evidence from a panel of selected Asian countries

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ABSTRACT

This study examined the relationships between climate change, energy resources, growth specific factors and their resulting impact on biodiversity loss in a panel of 18 selected Asian countries during the period of 2000–2014. The study employed panel fixed effect regression and panel quantile regression to assess the influence of different factors on biodiversity loss at low, medium, and high levels quantile distribution. The results show that climatic factors increase aquaculture production, whereas energy sources and growth specific factors affected the production of aquaculture in a panel of selected countries. Potential habitat area is affected by high population growth and renewable energy consumption whereas Global Environment Facility (GEF) biodiversity index is affected by average precipitation, foreign direct investment (FDI) inflows, and per capita income. Climatic factors and renewable energy both supported the total fisheries production, whereas nitrous oxide emissions, renewable internal freshwater resources, FDI inflows, per capita income, and population growth affected the production of total fisheries at different quantile distributions.

1. Introduction

According to Intergovernmental Panel on Climate Change [1] report, climatic variability is the global environmental concern that required a sustainable policy for addressing climate change and its consequential impact on extreme temperature, rising sea level, ecological plant and animal species, land use management, and ecosystem. It is desirable to formulate policies for mitigating Greenhouse Gas (GHG) emissions and reduced it limits within the threshold level ranging between 450 and 550 parts per million. Akram (2012, p, 1) argued that *"Asia is recognized as one of the most vulnerable regions to climate change on the planet. With approximately 60 percent of world's population residing in Asia, this phenomenon presents serious concerns for policymakers in the region".*

Asia is the largest region of the World that severely affected by climate change and energy security issues. Agricultural production is affected about 4% due to climate change and global warming, while net farm revenue is lost by 3% due to rise in 7% precipitation rate by rising 2 °C temperature. In addition, wheat and other agricultural crops also affected due to uneven rain fall that reduced agricultural productivity which seriously undermines Asian economy [2]. Clean energy policy is the policy dream for the Asian countries to mitigate greenhouse gas emissions and air pollutants that support to the Asian environment including ecosystem, fresh water resources, ecological species, human's health, economic wealth, and conservation of biodiversity. Table 1 summarizes the different factors that affect biodiversity in Asia including climate change, energy sources, and growth specific factors.

The study employed panel fixed effect and panel quantile regression in order to analyze the influencing factors that affect biodiversity at low, medium, and high-level with different quantiles distribution in a panel of selected Asian countries. This study

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Table 1
Factors affecting biodiversity loss in Asia.

Factors	Link to Biodiversity loss	Conservation Strategy
Climate Change	- Animal and plant species respond to the climatic variability in terms of reproduction, migration, and distribution of species from their normal flora. - Climate change affects the ecological species via the channel of agriculture production and environmental health. - Extreme temperature and rising sea level affects biodiversity. - Carbon dioxide emissions and greenhouse gas emissions largely affect the environment and economic considerations including health and wealth issues.	- Deforestation is an important factor that largely affects the biological diversity in the form of potential species loss, loss of herbs for medication purposes, and destruction of flora and fauna. The policies should be made to reduce deforestation in order to preserve our natural resources and ecological species for balancing the natural flora. - Low carbon and mitigate GHG emissions is desirable for sustainable policy. The intervening eco-friendly policies to avoid dirty pollution games through proper waste disposal and waste recycling helpful to reduce biodiversity loss. - High temperature affects early plant pollination process that changes the distribution of species. It further raises sea level that threatens to global biodiversity. The early lookup these problems to formulate policies to decrease the problem of global warming and alteration of early species reproduction made a way of sustainable journey.
Energy Sources	- The resulting impact on environment by fossil fuel energy consumption leads to carbon dioxide emissions ultimately increases greenhouse gas emissions that damage the ecosystem and global biodiversity.	- Conservation and efficiency measures may preserve the ecological species through improved management of habitat corridors, renewable internal fresh water resources, reforestation, clean air, etc.
Population growth	- The rapid population growth cumbersome the economic and environmental resources that further affected natural ecosystem and biodiversity. The following threats to biodiversity by human made activities and its rapid growth are as follows, i.e., a) Potential habitat area is affected. b) Imbalance of ecological equilibrium. c) Emerged new and toxic air pollutants. d) Climate change effects. e) Over and under exploitation of economic and natural resources etc.	- Conservation of biodiversity resources required population control strategies, environmental legislations, restricted dirty pollution by imposing environmental taxes, decrease deforestation, used renewable energy sources, produce environmental goods, and fully utilized economic and environmental resources.

Source: [1,3–6].

has a unique distinction in the academic literature; as its first examine the relationship between climate change, energy resources, growth specific factors and their resulting impact on biodiversity loss, while at the other hand, it's further assess the mean variations of explanatory factors on dependent variables at 25th, 50th and 75th quantiles distribution.

The importance of energy sources, growth factors, and environmental consideration is crucial for attaining sustainable development to conserve biodiversity in Asia. The main contribution of the study is to used number of climatic factors, including, average precipitation, carbon dioxide (CO_2) emissions, and GHG emissions, while previous studies limited to single or two factors (see, [7–10]; etc.). In addition, there are few studies that used average precipitation as a climatic factor under the protection of Kyoto protocol for biodiversity (see, [11–13,87] etc.). The climatic factors confined the need of appropriate balance between human actions and biodiversity conservation that is vital for environmental sustainability agenda across countries. Besides climatic factor, this study takes an initiative to add renewable energy resources, which is vital for sustainable development. The energy sources include nitrous oxide emissions of energy sector, renewable energy consumption, and renewable internal fresh water resources, all these resources helpful to reduce the environmental impacts on biodiversity loss across Asian countries. The previous studies confirmed the importance of renewable energy sources in sustainable development (see, [14]; [15–17]; etc.). The representation of biodiversity is followed by the following four promising variables, including, aquaculture production, forest area, Global Environment Facility (GEF) benefits biodiversity index, and total fisheries production. The GEF biodiversity index is utilized in the study of Zaman [10] and Zaman et al. [18]; where carbon emissions and biofuel production damages the biodiversity across the globe. Similarly, there are number of studies that utilized forest area as a proxy for 'potential habitat area' or biodiversity (see, [19,88] etc.), hence, this study used the same proxy for the biodiversity loss across Asian countries. It is evident that

global biodiversity is linked with the fresh water consumption [20], human population, and food production [21], while it is imperative to improve the water resources and aquaculture sources/marine sources both for human and fisheries [22]. These are the vital sources, which we considered in this study to use for specific factors of climate change, energy sources and biodiversity loss to propose an integrated sustainable agenda that support to the United Nations Kyoto protocol for biodiversity conservation for Asian countries.

The objective of the study is to examine the relationships between climate change, energy sources, growth specific factors, and biodiversity loss in a panel of 18 selected Asian countries during the period of 2000–2014. The more specific objectives are:

i) To what extent have average precipitation, carbon dioxide emissions, and GHG emissions affect the aquaculture production, forest area, GEF benefits biodiversity index, and total fisheries production by using panel fixed effect and panel quantile regression.
ii) To investigate the impact of nitrous oxide emissions of energy sector, renewable energy consumption, and renewable internal fresh water resources affect the biodiversity factors at low-level, medium-level, and high-level quantile distribution.
iii) To examine the relationship between FDI inflows, GDP per capita, population growth, and their resulting impact on biodiversity factors in a panel of Asian countries.

The study divided in to the following sections: after introduction which is presented in Section 1 above, Section 2 shows the review of literature. Section 3 shows the data and methodology, Section 4 discussed the results and final Section 5 concludes the study.

2. Literature review

The relationship between climate change and biodiversity loss is