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# *BIODIVERSITY REVIEW FROM EVOLUTION AND ITS INFLUENCES ON CLIMATE*

**Jamilah Nasution [1,*], Ferdinand Susilo[2], Nurmaini Ginting[3], Radiansyah Hadi Chandra[4]**
[1] Biological Sciences Posgraduate Program, FMIPA, Universitas Sumatera Utara, Indonesia
[1&2] Biology Study Program, Faculty of Sciences and Technology, Universitas Medan Area, Indonesia
[3] Biology Education Studi Program, FKIP, Universitas Muhammadiyah Tapanuli Selatan, Indonesia
[4] Mahesa Research Center, Indonesia
* Corresponding author : jamilah.nasution83@gmail.com

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**ABSTRACT**

*Biodiversity refers to the variety of organisms, including genes, species, and ecosystems in a given area. Biodiversity plays an important role in evolutionary processes and in maintaining the balance between the biosphere ecosystem and biological systems. Climate change is so important that contribute to the sustainability of biodiversity. Factors causing ecosystem damage include human population, habitat conversion and transformation, overexploitation, invasive species, pollution, and climate change. By stopping the rate of loss of biodiversity occurs in the world, it will automatically invest in the survival and welfare of every human being.*



## Introduction

Biodiversity is the abundance of different species on earth, the genes they contain, the ecosystems in which they live, and the processes by which the ecosystems form that sustains the energy flow and nutrient cycles of all life. Biodiversity refers to genetic diversity, which is the total number of genetic characteristics of a particular species, subspecies, or group of species. The existence of genetic diversity allows species to adapt and survive by adapting to environmental changes that occur. Species diversity is the clearest evidence of biodiversity and gene variation that occurs within species. The diversity of ecosystems such as deserts, grasslands, forests, mountains, oceans, lakes, rivers and wetlands is an important part of biodiversity.

Biodiversity plays an important role in maintaining healthy ecosystems and maintaining ecosystem services for growing populations. It can be illustrated by the amount of energy and time required for the formation of Mars or an Earth-like planet that is suitable for human survival. On earth, this process takes four billion years and requires the contribution of many functions of various life forms which are ultimately driven by evolution and this is only the tip of the iceberg (melting) (Bellwood et al., 2012; Dolby et al., 2015).

Biodiversity has many benefits for all aspects of life on this earth. The use of biodiversity in Indonesia varies in each

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region, ranging from the benefits of biodiversity for food, shelter, clothing, to handicrafts related to social culture. In addition, biodiversity has ecological functions related to ecological processes, namely the processes of growth, reproduction, and evolution. From this explanation, it can be concluded that biodiversity plays an important role, directly or indirectly, in ensuring human life and welfare (Kuswandi et al., 2014; Roziaty et al., 2017).

Exploited ecosystems are in dire need of long-term survival and well-being that are currently threatened by human actions. We are surrounded by global changes caused by human activities. The pervasive effects of climate change include habitat loss and fragmentation, overfishing, pollution, changes in nutrient cycles, invasive species and their interactions affecting almost every ecosystem on Earth (Rocksrom et al., 2009). We are currently at the beginning of a great environmental revolution, with 7 billion people harnessing natural resources faster than they can create. As a result, species change, evolve, disappear, change behavior and biophenology, take advantage of newly available food sources and leave behind something even rarer. Ecosystems are also changing, driven by changing environmental factors and the reorganization of biota into previously unknown species combinations (Williams & Jackson, 2007). The interaction of all these processes makes it difficult to predict changes in the ecosystem.

In general, evolutionary changes occur over a longer period of time than environmental changes. As a result, our view of biodiversity and ecosystem function is often static and seeks to preserve biodiversity as it is and should be. Just like our ecosystem, this paradigm is also changing. In many cases, with the help of new biological insights and technological advances, the closer we are to adaptive evolution, the faster it seems to happen (Indrawan et al., 2012). Evolution and ecology have proven to be so interrelated that it is increasingly difficult to tell them apart. This knowledge has a profound effect on our thinking about how evolution affects patterns of biodiversity, especially in the face of global change. As an example, adaptive responses to climate change have been shown to occur over several generations (Walujo, 2014; Alikodra, 2018). Evolution today may be more important than we previously thought, and therefore is likely to mediate the responses of populations, species, communities, and ecosystems to sudden and gradual changes in the environment.

## Results and Discussion

Biodiversity must be managed properly to ensure the protection of life support systems, protection of genetics, species and communities of various organisms, as well as environmental products/services that play a role in their utilization arising from the existence of biodiversity. Therefore, this paper discusses related to the condition of biodiversity, evolution and the effect of climate change on biodiversity.

### a. Biodiversity

Biodiversity refers to the different species that live and interact with a particular area. It includes all individual organisms and their populations and types, including genetic diversity and complex structures of communities and ecosystems (Leksono, 2010). Genetic diversity is the total number of genetic characteristics of a particular type, subspecies, or group of species. Species diversity is clear evidence of biodiversity. There is a genetic mutation in a breed. The existence of genetic diversity allows species to adapt and survive by adapting to environmental changes that occur. It is based on the biodiversity of the number of species; species uniformity, relative abundance of species and dominant species (most abundant species) (Kusmana & Hikmat, 2015).

Biodiversity is the result of millions of years of evolution, including regeneration and cladogenesis, resulting in two types of taxa, namely monotypes and polytypes. Monotype taxa are taxa with only one member, while polytype taxa are taxa with many members. Monotypic taxa are usually endemic and

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evolutionary rates are low, meaning that new mutations are rare or difficult to emerge. Therefore, the contribution of monotypic taxons to biodiversity is small. In contrast to polytype taxa which are widely distributed and have a higher evolutionary rate, their contribution to biodiversity is also high (Irawan, 2013).

The mechanism for the emergence of diversity begins with the isolation of the population of the same species. If populations are separated and isolated from each other, the exchange of genetic information will also be hampered. In this case, three types of estuarine crabs namely Helice tridens, Helice japonica and Chiromantes dehaani increased according to the distance between the estuaries where the three types of crabs lived, it is clear that there are genetic differences between the populations (Irawan, 2021). In this regard, it should be noted that Indonesia has many islands and rivers, and animals whose distribution includes many islands and rivers are not necessarily genetically identical.

In addition to describing the number of species, biodiversity can also be used to indicate the variability of certain taxa in an ecosystem. Therefore, the diversity of a taxon group can have many interpretations, but in general biodiversity can be divided into three levels, namely genetic diversity, species, and ecosystems.

Based on Sutarno & Setyawan (2015), population growth, which leads to increased consumption, is one of the main anthropogenic causes of decline and loss of biodiversity habitat. In addition, climate change is inevitable to cause changes in marine and terrestrial habitats. Our current level of consumption is a constant threat on this planet, affecting biodiversity and endangering many species. Hence, it is significant to take appropriate action to overcome it.

**b. Evolution**

Evolution is the process of changing species to adapt to the environment and pass these changes on to future generations. Evolution is a unified concept of biology since many aspects of biology, especially today's living organisms, are the ancestors of evolution and explain the diversity of life on this earth. The process of evolutionary change has three main process combinations: change, reproduction, and selection. Evolution occurs when differences in these genes become common in a population (Mergeay & Santamaria, 2012; Djuita, 2012; Taufik, 2019).

The basic assumption of adaptation stems from the evolutionary understanding that humans are always trying to adapt biologically/genetically and culturally to the surrounding natural environment. The process of adaptation in evolution involves genetic selection and cultural differences, and is considered the best way to solve environmental problems. Adaptation is also a dynamic process since neither organisms nor the environment are permanent (Mahmud, 2016).

Evolutionary adaptations that are continuously carried out and passed on to their offspring produce creatures that are completely different from their parents. This adjustment is based on natural selection. In this case, extreme environmental changes such as changes from a terrestrial environment to an aquatic environment have become the tool of choice for every organism. Therefore, the environment has made a choice, and only those who can adapt to the environment can survive. Natural selection involves the interaction of individuals (Bellwood et al., 2012).

According to the theory of natural selection, if these mutants could reproduce faster than normal humans, mutations would occur in the next few generations. Evolution is a natural process by which every life changes from generation to generation. Every creature inherits genetic tendencies from its parents. Genetic mutations in individuals can give rise to new characters in the next generation. If the new character can better adapt to the environment, then he will be more successful in survival and breeding. On the other hand, if a character reduces the resistance of a new individual, then the

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character is gradually removed from the organism population, along with the environment (Candramila et al., 2016; Taufik, 2019).

Natural selection is a continuous process since the environment is constantly changing. The adaptation process can be reversed if it does not adapt to environmental changes. In natural selection, favorable genotypes are accumulated and maintained so that these favorable traits are passed on to offspring (Walsh & Lynch, 2018). Various scientific studies have shown that some living organisms, such as plants and animals, are very sensitive to changes in temperature, suggesting that these changes can interfere with natural selection. The attitude of males of different types of amphibians and reptiles towards females is unbalanced. Some plants die in forest fires. Shrubs began to penetrate into the melting poles. Sea water that reaches the mainland disturbs the balance of the wetland ecosystem (Chandramila et al., 2016; Helmi,2017).

**c. Effect of Decreasing Biodiversity on Climate Change**

Biodiversity is the basis for the emergence of various ecosystem services, both in the form of goods/products and in the form of environmental services that are indispensable for the life of wild animals, especially human life (Wahyudin et al., 2019; Santoso et al., 2020). Over the last few decades, due to population growth and rapid development in various sectors, many natural ecosystems that provide the various services and environmental products mentioned above have been damaged by various factors, namely:

- Human population; One of the factors causing the decline in biodiversity is the increase in the human population. The impact of human population increases the need for clothing, food and shelter. As the human population grows, there is an insatiable need for raw materials which will inevitably lead to changes in biodiversity. Human population affects the loss of biodiversity worldwide, which is highly dependent on the global human birth rate. Therefore, it is significant to control the human population, which leads to the conservation of biodiversity (Rasmikayati & Djuwendah, 2015; Rinawan, 2015).
- Habitat Conversion and Transformation; Overall, the main factor that directly drives the loss of biodiversity worldwide is habitat change and destruction. Habitat conversion causes all habitat functions to be unable to support the species in their habitat. Biodiversity is reduced in this process when organisms present in the habitat are removed or destroyed. Habitat destruction by humans increased rapidly in the twentieth century. Natural habitats are often destroyed by human activities to extract natural resources for industrial production and urbanization. Deforestation of forest areas for agriculture, conversion of river habitat to lake habitat (waduk) with the construction of hydroelectric power projects in rivers, mining, logging, urban expansion, road construction are some of them. The increasing unsatisfied demand for resources has led to changes in land use. Thus, the loss of genetic diversity, species reduction and increased ecosystem changes such as random population changes, disease outbreaks and habitat fragmentation, among others, have led to the loss of biodiversity (Kuswana & Hikmat, 2015).
- Overexploitation; It occurs when individuals of a particular species are harvested at a rate higher than the natural reproductive capacity of the harvested population can support.This can be done through hunting, fishing, trading, gathering food, etc.Excessive exploitation of flora and fauna will lead to species scarcity and extinction. In addition, the homogeneity of plant species and livestock breeds causes genetic degradation. All of this can lead to a biodiversity crisis. Uncontrolled exploitation of biological resources will have a negative impact on human life. In general, biodiversity can be used economically to generate large profits without taking into account environmental

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damage (Baransano & Mangimbulude, 2011).

- Invasive type; Non-native plants and animals inhabiting an ecosystem can cause problems for native species and their habitats.Various flora and fauna can be spread in the area with human assistance, for example agricultural activities that use foreign animals and plants imported from other countries. Rare species grow and evolve to eradicate local species by changing the gene pool, or the spread of pests and diseases that threaten biodiversity in several areas (Hermawan et al., 2019).
- Pollution; Faster industrial activities to meet the needs of life, especially humans, and increasingly intensive agricultural activities to increase productivity cause soil, water and air pollution. Pollution will have a serious impact on biodiversity, both at the genetic, species and ecosystem levels (Astra, 2010; Mangunjaya, 2015)
- Climate change; As the number of people who need different products and services to support their lives increases, the development in various regions is accelerating to meet the needs of various products and services of the population. Many development activities, especially in industrial activities and transportation, use greenhouse gases (mainly CO2). In addition, evolution has changed non-vegetative productive soils, thereby reducing the potential for carbon dioxide in the atmosphere. This phenomenon causes global warming to cause climate change. These conditions increase sea level, distribution patterns and changes in the rainy season, increase the frequency of natural disasters (droughts, floods, landslides, etc.) that can affect biodiversity (Suryati, 2007; Mangunjaya, 2015).
- Global warming; Rising surface temperatures, melting Arctic ice, and rising sea levels are some of the features that occur as a result of global warming. But not only that, global warming is slowly but surely affecting biodiversity, from the species level to the ecosystem. Finally, human life will also be affected by climate change. Global warming is a phenomenon caused by an increase in the maximum concentration of greenhouse gases such as CO2, CH4, NOx, CFCs and other gases in the atmosphere. This causes sunlight to be reflected back to Earth in the form of infrared and ultraviolet radiation that is sent into space, but most of it is reflected back to Earth by greenhouse gases in the atmosphere, causing the Earth to warm. Most of the causes of greenhouse gas emissions are human activities. In addition, forest fires greatly affect the release of CO2 into the atmosphere, and illegal logging is one of the main causes of reduced CO2 uptake by plants. Global warming also affects ocean temperatures, as evidenced by the fact that many marine species migrate to the Arctic to achieve cooler environmental temperatures (Suryati, 2007; Latuconsina, 2010; Lubis, 2011).

With regard to the above factors, biodiversity must be protected, managed and improved to ensure the sustainability and use of biodiversity for the improvement of human well-being.

## Conclusions

If biodiversity is extinct today, human survival will be threatened in the near future. It is related to the decline in biodiversity, the effects of human activities that lead to climate change.Human wisdom is one of the keys to success in this endeavor. We need to conserve natural ecosystems, protect and enhance ecosystem capacities, manage habitats for endangered species, create protection and buffer zones, and build a network of protected areas on land, water and sea, taking into account climate change forecasts.

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