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Assessment of the impact of COP decisions on biodiversity and ecosystems

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Abstract. The relevance of the study is conditioned by the fact that any anthropogenic load or economic activity has an impact on the functioning of natural ecosystems, as demonstrated by the widespread practice of oil palm expansion. The purpose of this study was to develop methods for assessing strategies that play an important role in strengthening measures to protect biodiversity and ecosystems in Africa and Latin America, considering the impact of the decisions of the United Nations Climate Change Conference. The study considers the materials of various international organisations on the problems of biodiversity related to climate crises, inefficient territorial planning,

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expansion of land for growing crops that deplete the soil or reduce the area of land needed to accommodate biota. The paper presents a sequence of steps to assess the impact of the decisions of the United Nations Climate Change Conference on biodiversity and ecosystems. The aspects of conservation of biodiversity and ecosystems in the context of the expansion of palm plantations are substantiated. The indicators of the ratio between the available land area for palm oil cultivation and the area threatening to reduce the biodiversity of Africa are analysed. Environmental solutions are substantiated, which correspond to the provisions of the United Nations Climate Change Conference in the context of biodiversity and ecosystem conservation, taking into account the expansion of large areas for palm plantations in Colombia. The practical significance of this study lies in the development of a methodology for the economic and mathematical assessment of the decisions of the United Nations Climate Change Conference, which affect the conservation of biodiversity and ecosystems, and are the driving mechanism in creating an effective control system for tracking oil palm plantations, territorial development with the least environmental losses and high economic efficiency

Keywords: United Nations; climate transformations; territorial planning; environmental management; resource potential; oil palm plantation

INTRODUCTION

The United Nations Climate Change Conference 29 (COP) will be held from November 11 to 22, 2024 in Azerbaijan. This is an extremely important event to address various aspects of climate change, biodiversity conservation and protection, and to decide on the next steps in combating global environmental challenges. Recent meetings at the UN Climate Change Conference, in particular COP 27 and COP 28, were devoted to the issues of changing the temperature regime, which has a serious impact on the global ecosystem, including the structure of forests, oceans, mixed and polar ecosystem landscapes (United Nations Development Programme, 2023). For example, rising temperatures and changes in precipitation can lead to landslides, flooding, and other disasters that negatively affect biodiversity.

Assessing the impact of COP decisions provides insight into how effective the measures taken have been in conserving biodiversity and ecosystems. This is important for assessing the effectiveness of policies and identifying possible ways to improve, identifying possible conflicts between different initiatives and priorities, and understanding which solutions require greater coordination and cooperation between countries (United Nations Development Programme, 2023).

In recent years, the world community for the protection of natural resources has been paying more and more attention to the problem of palm plantations expanding significant areas of land. First of all, this situation is caused by the fact that the demand for palm oil is constantly growing due to its widespread use in the food and light industries, and in the production of alternative fuels. The expansion of palm plantations leads to the destruction of natural ecosystems and loss of biodiversity. The destruction of forests and other natural environments leads to the extinction of various plant and animal species, including those that are unique or already endangered (Kross *et al*., 2022).

The forests capable of absorbing carbon dioxide from the atmosphere are destroyed. This leads to the release of large amounts of CO_2, which contributes to climate change. In addition, reducing the number of trees in forests can lead to the loss of other ecosystem services, such as water conservation and maintaining high levels of soil fertility. In particular, the cultivation of palm plantations is associated with the use of pesticides and other chemicals, which has a detrimental effect on the health of the local population (de Mendonça *et al*., 2022).

The impact of the expansion of palm plantations on agriculture in Latin America was investigated by A. Castellanos-Navarrete *et al*. (2021). The results of the study show that industrial plantations entail risks of disturbance and degradation of local landscapes, especially on forest borders. This leads to loss of biodiversity, conflicts between small-scale palm plantation owners and the local population, which depends on the level of ecosystem services of forests.

The features of the transformation of natural savannahs into a plantation of oil palms in the Llanos of Colombia and their impact on the diversity of birds are analysed by L. López-Ricaurte *et al*. (2020). Significant changes in biodiversity and the number of bird species were detected as a result of this expansion. The researchers give suggestions on the formation of a detailed monitoring system for the conservation of natural savannahs.

The main technical and technological parameters of palm oil certification, considering the standards of the Roundtable on Sustainable Palm Oil (RSPO) (n.d.) and Malaysian Sustainable Palm Oil, are described in the paper by M.A. Hassan *et al*. (2024). Technological progress in this area corresponds to the zero emissions system and contributes to cyclical bioeconomics and reduction of negative impact on the environment. The expansion of oil palm plantations in Amazonian forests leads to a significant reduction in the area of perennial forests and degradation of unique natural landscapes, as noted by K.C.L. da Silva *et al*. (2023). There are almost irreversible changes in land use with accelerated loss of forests and deterioration of the ecological

situation. The management of this sector requires strategies aimed at the conservation or restoration of biodiversity landscapes.

Despite a number of studies, the problems of individual bioregions that are most affected by the large-scale expansion of oil palms remain rather neglected. Another important issue is the characterisation of specific biota species, especially vulnerable to this process. The problems of restoring degraded soils after deforestation are also worthy of attention. As a result, methods for assessing the decisions of the UN Conference on Climate Change affecting the conservation of biodiversity and ecosystems as a result of the expansion of palm plantations should be improved (Tashiro *et al.*, 2019).

The aim of this study is to analyse the effectiveness of various measures taken by COP to conserve biodiversity in unique natural ecosystems using the example of the impact of palm plantation expansion in Africa and Latin America, followed by the development of recommendations for economic and mathematical assessment of strategies to enhance the protection of flora, fauna. The main problems that need to be addressed are based on the use of economic instruments that are necessary within the framework of COP for the protection of flora and fauna, but at the same time may be ineffective in the context of the expansion of palm plantations in Africa and Latin America. The use of mathematical models in the process of conducting economic assessments can improve the effectiveness of strategies for protecting biodiversity in regions affected by palm plantations.

It is also necessary to adapt existing COP strategies for the protection of flora and fauna to the specific conditions of a particular region, considering the features of the expansion of palm plantations. And increased investments in innovative technologies and methods for the protection of biodiversity can lead to a reduction in the loss of natural ecosystems in different regions of the world, which are subject to the expansion of palm plantations.

MATERIALS AND METHODS

The research information base has compiled data from the report by United Nations Development Programme (2023), report and the COP conference's work streams on climate change, biodiversity conservation and protection, and decision-making on the way forward in addressing global environmental challenges. Data from the Intergovernmental Panel on Climate Change (2022) synthesis report were used, related to climate crises, inefficient spatial planning, expansion of land for crops and tree stands that deplete the soil or reduce the amount of land needed to accommodate biota. For a more detailed justification of COP's decisions in the field of conservation and protection of biodiversity within unique ecosystems, the provisions of the International Union for Conservation of Nature (2023), National Adaptation Plans (2023) and long-term low-emission development strategies (United Nations, 2023) were considered. The data of the Joint Research Centre (2023) and the French Agricultural Research Centre for International Development (2023) regarding the main indicators of the potentially serious impact of the expansion of the palm oil industry in Africa were analysed. The results of reports by RSPO (n.d.) on market transformation in Latin America, the Dutch non-governmental organisation AidEnvironment, National Oil Palm Federation (2020), the non-governmental organisation Solidaridad (2022) and Rainforest Alliance (2022) were studied.

The scientific research was based on economic (the law of self-interest, the law of supply and demand), environmental laws (laws of biodiversity, climate change, toxic and dangerous substances, land and water), mathematical patterns of their concepts, categories and modern geographical theories. The paper summarises the decisions taken within the framework of COP 28 on biodiversity conservation, considering the position of the International Union for Conservation of Nature in achieving the goals of the Paris Agreement in the context of the areas of protection, restoration and sustainable management of global ecosystems. Environmental solutions are considered, which are evaluated based on the indicators of economic effect with the conservation of biodiversity and the implementation of sustainable development goals.

A systematic analysis has been applied to substantiate the main aspects of biodiversity and ecosystem conservation in the context of palm plantation expansion, which are influenced by COP decisions. The relationship between the available land area for palm oil cultivation and the area threatening the reduction of primate biodiversity in Africa is characterised. The influence of the expansion of oil palm plantations on the differentiation of biodiversity and the state of natural ecosystems within the territory of Africa and Latin America is compared. In particular, environmental solutions regulated by the COP in the context of the conservation of biodiversity and ecosystems, considering the expansion of large areas of land for palm plantations in Colombia, are indicated. The study provides a rationale for mathematical and economic methods that are used to assess decisions and strategies related to the conservation of biodiversity and ecosystems in the context of the expansion of oil palm plantations.

RESULTS

The decisions taken within the framework of COP 28 on biodiversity conservation, taking into account the position of the International Union for Conservation of Nature, provided a critical opportunity to assess collective progress towards achieving the goals of the Paris Agreement (López-Ricaurte *et al.*, 2020). During the discussions, proposals were made to eliminate the

existing problems of conservation and protection of biota, considering the specific features of natural ecosystems. The provision of the International Union for Conservation of Nature during COP 28 regulates the clear definition, support, and substantiation of the areas of restoration and sustainable management of global ecosystems (United Nations Development Programme, 2023). It is noted that any conservation decisions are evaluated against indicators of economic benefits with biodiversity conservation and the realisation of sustainable development goals.

The representative office of the International Union for Conservation of Nature emphasises the importance of ensuring greater operational synergy in all key international policy processes governing the functioning of terrestrial, freshwater, coastal and marine ecosystems of the world. In particular, it is important to establish and strengthen appropriate functional links between key environmental management tools and their policy mechanisms. In particular, this refers to the Order of the President of the Republic of Azerbaijan "On Approval of the 'National Strategy of the Republic of Azerbaijan on Conservation and Sustainable Use of Biodiversity for 2017-2020" (2016), Convention on Biological Diversity (1993) and Paris Agreement (2015).

In particular, the provisions of the International Union for Conservation of Nature contain regulatory issues for the conservation of biodiversity and natural ecosystems and regulate their inclusion in National Adaptation Plans (2023) and long-term low-emission development strategies (United Nations, 2023). One of the important decisions taken at COP 27, which will further affect the situation with biodiversity, was based on consideration of the feasibility of environmental decisions or approaches related to ecosystem changes in general, taking into account UN Assembly Resolution 5/5 on the environment. In particular, it is necessary to implement measures to mitigate the effects of reducing biological diversity and adapting to changes in the territorial climate regime, while ensuring appropriate social and environmental guarantees (Decision 1/CP.27, paragraph 52 and Decision 1/CMA.4, paragraph 81) (United Nations Development Programme, 2023).

The International Union for Conservation of Nature encourages all actors implementing environmental solutions through the market or non-market mechanisms to follow a high-integrity approach when developing, verifying, and expanding such initiatives. To do this, it is necessary to use nature-based solutions (NBS) that contribute to the conservation of biodiversity, and can also have additional benefits for society, such as improving air and water quality, improving people's physical and psychological health, reducing the risk from natural disasters, increasing resilience to climate change.

The problem of conservation and protection of biodiversity and ecosystems should be resolved through reliable accounting systems, which will contribute to the observance of appropriate social and environmental guarantees. Assessing the impact of the decisions of the UN Climate Change Conference on biodiversity and ecosystems is critically important, since actions taken to combat climate change have a significant impact on the natural environment. For example, the deployment of renewable energy sources such as solar and wind energy can have both positive and negative impacts on biodiversity and ecosystems (Fig. 1).

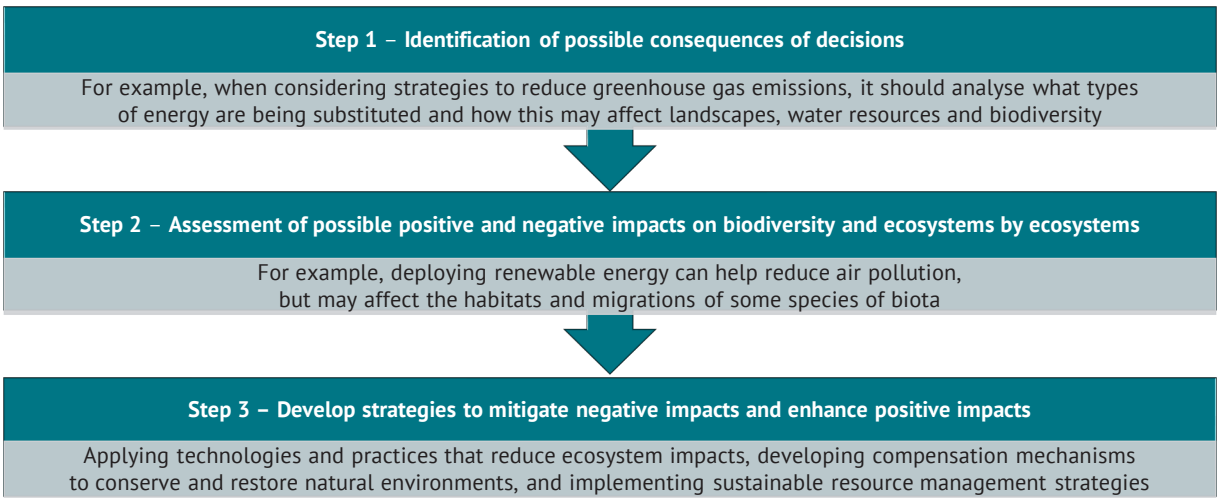

***Figure 1**. Step-by-step rational for assessing the impact of the UN Climate Change Conference decisions on biodiversity and ecosystems*
***Source:** compiled by the authors based on United Nations Development Programme (2023)*

The expansion of palm oil plantations poses a serious challenge to biodiversity, especially in the tropical regions where they are usually located. In this case, tropical forests are often used to create palm oil plantations, which leads to their deforestation and destruction of natural habitats for numerous species of plants

and animals. This problem is especially acute for those animal species that are on the verge of extinction or are already in danger of extinction.

In recent years, Africa and South America have been key regions for the expansion of palm plantations due to their favourable climatic conditions and potential for palm cultivation. In the region of Southeast Asia, which used to be the main centre of palm oil production, the limits of acceptable spatial spread and land-loading have almost been reached. Therefore, many companies producing this product cooperate with Nigeria and Cameroon. Latin America is becoming increasingly attractive for the expansion of palm plantations. Colombia, Ecuador, Peru, and Brazil are countries with the potential to expand palm plantations. In particular, decisions taken during the COP and strategies to address environmental challenges also have a significant impact on biodiversity in Africa and Latin America, especially in the context of the expansion of oil palm plantations (Table 1).

***Table 1**. Substantiation of the main aspects of biodiversity and ecosystem conservation in the context of palm plantation expansion, which are influenced by COP decisions*

Aspect	Substantiation
Regulation of land use	COP's decisions include international agreements and regulations related to the use of land and forests. These decisions may affect the location and development of oil palm plantations, including limiting the conversion of forests into agricultural land.
Support for alternative energy sources	Reducing the use of petroleum products and switching to renewable energy sources may reduce the demand for palm oil as a biofuel. This can reduce the need for palm oil production and pressure on the ecosystems involved in their cultivation.
Support for local communities	Strategies to address environmental challenges may include measures to support local communities to promote their participation in natural resource management. This can help in the implementation of sustainable forest management practices and reduce the pressure on forest ecosystems.

***Source:** compiled by the authors based on Intergovernmental Panel on Climate Change (2022)*

In the context of the expansion of oil palm plantations, it is important that decisions and strategies ensure a balance between economic and social needs and the conservation of biodiversity and ecosystems. Only in this way can sustainability of development be achieved, contributing to both economic prosperity and environmental conservation. The results of studies conducted by the Joint Research Centre (2023) and the French Agricultural Research Centre for International Development (2023) confirm the potential serious impact of the expansion of the palm oil industry on African primates. Only a few small areas in Africa are considered highly suitable for oil palm cultivation and have a low potential impact on the species of primates living there (Fig. 2).

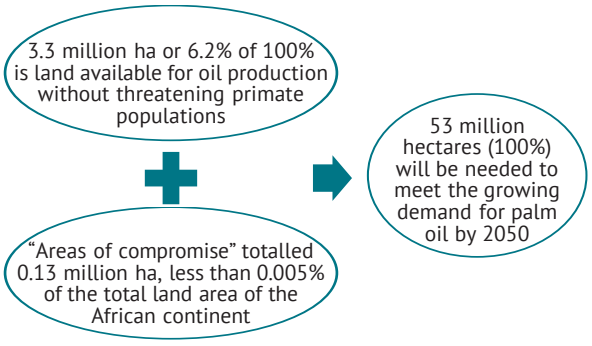

***Figure 2**. The ratio between the available land area for palm oil cultivation and the area threatening to reduce primate biodiversity in Africa*
***Source:** compiled by the authors based on R. Sourokou et al. (2023)*

Figure 2 shows a diagram of the proportions between the "compromise zones" suitable for palm oil cultivation and the general demand for such land until 2050. It also demonstrates the limited availability of areas for palm oil cultivation without harming the primate population. In light of the catastrophic impact of industrial oil palm plantations on wildlife in Southeast Asia, a large-scale assessment of the expected effects of oil palm expansion on the diversity of African primates should be carried out, with particular emphasis on challenges that may arise in the future (Convention on Biological Diversity (1993). Economic assessment is quite difficult due to the heterogeneity of the economic value of biodiversity and difficulties in determining economic parameters. However, several approaches can be used to assess the expected effects of oil palm expansion on the diversity of African primates.

The development of ecotourism areas in the overall biodiversity conservation strategy contributes to increasing public awareness and support for basic nature conservation measures. Ecotourism provides an opportunity for monitoring and research on biodiversity, which can help identify vulnerabilities and ineffective conservation strategies. In the case of one region of Africa, if primates attract tourists, their loss may lead to a decrease in income from ecotourism. The equation is recommended to be formulated as follows (1):

$$E = N \times V, \quad (1)$$

where E – total economic impact, N – number of tourists who want to observe primates, V – average cost of the tour.

If the loss of primates leads to a loss of genetic diversity, which may affect the biopharmaceutical industry and other industries. The equation is recommended to be formulated as follows (2):

$$G = Q \times P, \quad (2)$$

where G – cost of loss of genetic resources, Q – number of useful genetic properties, P – average cost of a genetic resource.

Changes in primate diversity can affect ecosystem services such as plant pollination or seed distribution. The equation is recommended to be formulated as follows (3):

$$F = \sum_{i-1}^{n} (Ai \times Vi), \quad (3)$$

where F – total cost of ecosystem functioning change, Ai – number of ecosystem services changed, Vi – cost of each service. Equations can be modified depending on the available data.

Thus, decisions regarding the problems of conservation and protection of biodiversity in the context of the uniqueness of ecosystems affect the solution of issues of palm oil plantation expansion and primate vulnerability by developing environmental criteria for the transformation of land. This approach can be an effective key to minimise the species-specific impact on the expansion of oil palm plantations. In particular, such environmental criteria may include:

1. Prohibition of the placement of plantations in particularly vulnerable areas – legislative restriction on the placement of oil palm plantations in areas where vulnerable primate species live or where their biodiversity is especially significant.

2. Creation of natural corridors – preservation and creation of natural corridors that provide a link between the tracts where primates live, to facilitate migration and the spread of populations.

3. Primary forest conservation is the prevention of deforestation of primary forests and the preservation of these environments as irreplaceable habitats for many primate species.

4. Setting boundaries for plantation expansion – definition of boundaries for the expansion of oil palm plantations to avoid habitat loss and destruction of ecologically important territories for primates.

These conservation criteria can be effective tools to ensure the conservation of primates and other species in the wild in the face of increasing pressure on land resources to expand oil palm plantations. Although the palm oil-producing countries in Latin America do not lead the global palm oil market, they successfully maintain relatively stable indicators of consistency. This situation is developing because this region has the highest percentage of certified palm oil in the world, which is about 35% according to RSPO (n.d.) experts in Latin America. It is important to note that in Latin America, palm oil plantations are mostly located in forested areas that are unsuitable for other crops, and tree stands and are degraded or unproductive. This afforestation concept is in line with COP directions in the context of preserving forest ecosystems and implementing effective conservation measures.

Despite the high level of environmentally safe palm oil production and, in general, effective territorial planning of plantations of this type of stand, nevertheless, experts of the National Oil Palm Federation (2020) note the threat of deforestation for the cultivation of oil palm. Thus, in the period from 2021 and 2022, 23,311 hectares of forest were burned around these plantations to make room for their further expansion. Currently, the territory of Colombia is involved in solving issues of maintaining the stability of palm oil production. National Oil Palm Federation (2020), the NGO Solidaridad (2022) and Rainforest Alliance (2022), and the initiators of the review, correction and improvement of methodologies of the International Union for Conservation of Nature and the Dutch NGO AidEnvironment.

The RSPO uses various procedures, including the Remediation and Compensation Procedure (RaCP), to prevent deforestation and ensure regeneration. RaCP covers companies that control lands of high conservation value) and require restoration or compensation for lost value. This may include direct restoration of sites or support for conservation projects funded over 25 years. This mechanism is considered as a form of "green washout", emphasising the need to improve the quality of medicinal products through cooperation with other product certification standards. Environmental decisions regulated by the COP in the context of biodiversity and ecosystem conservation, considering the expansion of large areas of land for palm plantations in Colombia, may include the following aspects:

1. Zoning strategies – identify and protect areas of high biodiversity, such as nature reserves, national parks, and other unique landscapes. It is also important to consider the potential of migration corridors to ensure the conservation of species diversity.

2. Use of sustainable forest management – continuation and development of sustainable forest management programmes that contribute to the conservation of natural forests and their ecosystems instead of cutting them down in favour of palm plantations.

3. Certification and standardisation – the application of certification standards such as the RSPO, which establish requirements for sustainable palm oil production, including the conservation of forests and biodiversity.

4. Ecosystem restoration – support programmes for the restoration and rehabilitation of ecosystems damaged as a result of the exploitation of palm plantations to restore biodiversity and environmental sustainability.

5. Risk management – identification and reduction of potential negative impacts of palm plantation expansion on biodiversity and ecosystems.

Assessment of COP decisions affecting the conservation of biodiversity and ecosystems as a result of the expansion of palm plantations can be carried out using mathematical and economic methods. Modelling of biodiversity loss occurs through the use of mathematical models to assess the impact of palm plantation expansion on the diversity of species and ecosystems in a particular area. Models can include factors such as changes in land use, loss of natural habitats of species.

The assessment of economic losses is determined due to the economic value of the loss of biodiversity and ecosystem due to the expansion of palm plantations. This may include the loss of environmental services such as air and water purification, soil fertility maintenance. The analysis of the cost of losses and income from palm oil production is carried out by comparing the economic cost of losses of biodiversity and ecosystems with the profit from palm oil cultivation. This will help to understand the economic acceptability of COP decisions related to palm plantations. The development of mathematical models or optimisation algorithms to find strategies takes place to minimise the loss of biodiversity and the ecosystem, ensuring economic sustainability (Fig. 3).

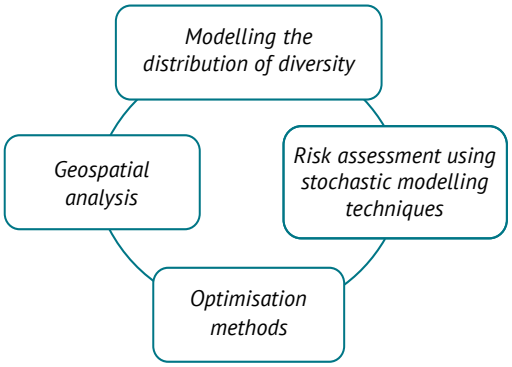

***Figure 3**. Mathematical methods used to assess decisions and strategies related to the conservation of biodiversity and ecosystems in the context of the expansion of oil palm plantations*
***Source:** compiled by the authors*

Considering the information from Figure 3, it is possible to create mathematical models that include factors affecting the distribution of diversity, such as loss of the natural environment and fragmentation of local ecosystems. Stochastic modelling methods can be used to assess the risks associated with the expansion of oil palm plantations for biodiversity. This allows considering the uncertainty and randomness of the impact of these actions on ecosystems. Mathematical optimisation methods can be used to find optimal strategies for resource management and land use for biodiversity conservation. This may include maximising biodiversity conservation while limiting losses from the expansion of oil palm plantations.

Mathematical methods of geospatial analysis can be used to identify areas with high levels of biodiversity that are most at risk due to the expansion of oil palms. This method simplifies the adoption of important environmental management decisions to preserve ecosystems. These mathematical methods can help in assessing the impact of decisions and strategies adopted at the Conferences of the Parties (COP) on biodiversity in Africa and Latin America, in particular in the context of the expansion of oil palm plantations. The economic assessment of COP decisions affecting the conservation of biodiversity and ecosystems as a result of the expansion of palm plantations can be made up of several key elements.

The cost of loss of biodiversity and ecosystem includes losses of ecosystem services, economic losses, threats to human health and well-being, and a decrease in the potential of environmental management, which cannot be estimated in monetary terms. Therefore, the protection and sustainable use of natural resources, including the management of palm plantations, should include careful sustainability and measures to minimise negative impacts on biodiversity and ecosystems (4)**:**

$$C = \sum_{i-1}^{n} (Pi \times Qi), \quad (4)$$

where *Pi* – economic value of the lost biodiversity or ecosystem for a species or ecosystem, *Qi* – amount of lost biodiversity or ecosystem.

One of the main reasons for growing an oil palm is the high productivity of this plant in relation to the oil it produces. Palm oil is widely used in various industries, including the food industry, cosmetics industry, household chemicals and fuel industry (5):

$$B = R - C, \quad (5)$$

where *R* – total profit from the sale of palm oil.

The cost of alternatives (A) may include the loss of other ecosystem services (water and climate management, biodiversity maintenance) that can be provided by natural landscapes occupied by palm plantations (6):

$$A = \sum_{j-1}^{m} (Cj), \quad (6)$$

where *Cj* – cost of loss of biodiversity or ecosystem for alternative *j*.

The cost estimate of conservation measures (E) includes the costs of establishing and maintaining nature reserves, national parks and other areas where economic activities are prohibited or restricted, including palm plantations. In addition, the costs of monitoring the implementation of legislation in the field of environmental protection and compliance with sustainable management standards should be considered (7):

$$E = \sum_{k-1}^{l} (Ck), \quad (7)$$

where *Ck* c– cost of conservation measures for a species or ecosystem *k*.

The Economic Sustainability Index (ESI) allows a balanced assessment of the economic aspects of the expansion of palm plantations and their impact on the sustainable development of the region. This indicator helps to identify potential risks and problems, and opportunities to improve business practices to achieve more sustainable results (8):

$$ESI = \frac{B+E}{B-E} \times 100\%, \quad (8)$$

where *B* – economic benefits of palm plantations, *E* – cost of conservation measures.

The use of equations 1-8 helps to identify new opportunities for the creation of innovative economic instruments, models, development strategies and financing mechanisms that contribute to the conservation of biodiversity and ecosystems. However, indicators of the potential for the development of ecosystem services markets will increase. There will also be the creation of compensation funds and programmes to support sustainable land management.

In general, the economic assessment of COP decisions on biodiversity and ecosystem conservation in the context of palm plantation expansion plays a key role in making informed decisions that contribute to achieving sustainable development. It provides a framework for the development of effective strategies and activities that consider both economic and environmental aspects and contribute to the achievement of global goals to combat climate change and preserve biodiversity.

DISCUSSION

The expansion of palm oil plantations has a serious impact on biodiversity, as it leads to the loss of forests, the destruction of habitats for numerous species of flora and fauna, and a decrease in their diversity. Such dynamics are becoming a threat to unique natural ecosystems, which can have negative consequences for the entire planetary environment and human well-being. This study helps to understand the complex relationships between the expansion of palm oil plantations and changes in natural ecosystems. This helps to understand the scale of the problem, determine the main factors causing the destruction of biodiversity, and identify vulnerable areas. The results obtained help to identify key ecosystems and species that require special attention and protection, as demonstrated by the example of Africa and Latin America. These substantiations allow developing a strategy for the conservation and restoration of natural resources and increasing the resilience of ecosystems to the effects of anthropogenic activities. It is important for the public to understand the problem associated with the expansion of palm oil plantations and their impact on biodiversity and natural ecosystems. Overall, this study is a critical step towards the sustainable use of natural resources and ensuring the ecological stability of the planet.

During the COP, various approaches to reducing the impact of the expansion of oil palm plantations on biodiversity are discussed. The decisions taken at the COP are important for the development and implementation of policies, laws and strategies aimed at protecting biodiversity and countering forest loss due to the expansion of oil palm plantations. The same conclusion in their research was reached by Z. Jia *et al.* (2024) and E. Meijaard *et al.* (2023). This is important because biodiversity is a key component of sustainable development and ensuring the ecological sustainability of the planet, according to M. Cordella *et al.* (2022). Conservation of biodiversity is essential for ensuring food security, supporting ecosystem services and adapting to climate change.

The assessment of the impact of the expansion of oil palm plantations in Thailand on biodiversity has a significant impact on the conservation of the diversity of bird and insect species in five regions of the country, which is substantiated in the paper by U. Jaroenkietkajorn *et al.* (2021). Scientific research contains data on the availability of biota species, and on available land use areas to determine the relationship between these two elements of the ecosystem. Special attention is focused on the deforestation of oil palm forests, which is considered the greatest threat to wildlife according to N. Boke Olén *et al.* (2021). The results of the study show that the possibility of survival of animals in former mangrove forests is higher compared to other types of forests after occupation. It was also found that deforestation in the northern region leads to fewer species losses in the area. It is impossible to disagree with the fact that the impact of expansion of palm oil plantation areas on faunal species diversity depends on the particular taxon and the combination of region and forest type. This study provides a substantiation for the case in Africa, where there is a problem of primate conservation, caused precisely by the need to expand the area of land for the cultivation of oil palms. At the same time, the characteristics of a particular region and type of forest are considered in order to preserve biodiversity.

The European Commission expresses strong arguments on palm oil production's potential negative impacts on land use, in particular, due to changes in the scale of production that could lead to deforestation of tropical forests according to B. Azhar *et al.* (2021) and M. Romero *et al.* (2019). Representatives of the main producing countries, such as Indonesia and Malaysia, argue that the measures proposed by the EU may create excessive barriers to environmental initiatives in the industry and violate the principles of free trade. These issues were considered by Y. Xin *et al.* (2022). However, the solution to this problem, which correlates with COP initiatives, is to reform land use policies for the main producing countries due to the mandatory division of land with farmers who have lost land for some reason

or are forced to change their location. These mechanisms will help reduce deforestation and encourage the use of existing palm plantations for agricultural purposes (Naime *et al*., 2020; Bai *et al*., 2023), and the strategy is consistent with the requirements of palm oil certification for social and environmental sustainability (Vincenza *et al*., 2024).

Mitigation of the risk of negative land use change in palm oil production is a high priority. Indeed, indicators of qualitative and quantitative parameters of land resources also affect effective territorial planning, which, in turn, depends on the uniqueness of natural ecosystems and the location of diverse biota (Liu *et al*., 2022). Thus, R. Sourokou *et al.* (2023) examined the relationship between the available land area for palm oil cultivation and the area threatening to reduce primate biodiversity in Africa. It has been possible to establish that there is limited availability of areas in Africa for palm oil cultivation without affecting the primate population.

C. Basnou *et al.* (2020) investigated the features of the development of a spatial distribution plan that considers the expansion of oil palm plantations and the impact of this expansion on biodiversity. A detailed study of the situation in Colombia revealed that there are territories where the expansion of the oil palm is fraught with a variety of vertebrates that are under threat of extermination. Especially low biodiversity indicators and risks are observed in the territories of Serrania de la Macarena, the transition between the Andes and the Amazon, Darien and the Tumaco forests. So these territories should be avoided when planning the expansion of oil palm plantations. That is why the application of an approach to effective territorial development may be acceptable for other countries facing the expansion of oil palms to ensure a balance between production and conservation of biodiversity.

The situation in Colombia regarding the placement of palm oil plantations and their expansion has also been investigated in this study. Indeed, the issue of effective territorial planning is extremely important in solving problems of conservation and protection of biodiversity. Thus, within the framework of the COP for the conservation of biodiversity and ecosystems in Colombia, possible conservation measures include zoning strategies. This means the identification and protection of areas with high biodiversity, such as protected areas and national parks, as indicated by K. Xu *et al.* (2020) and J. Yuan *et al.* (2023). In addition, according to G. Guzmán *et al.* (2022), it is important to consider possible migration routes to ensure the conservation of species diversity.

The main areas of conservation of important territories to improve communication in support of biodiversity conservation, adaptation to climate change and the rights of indigenous peoples, which is a key area of environmental policy, which, in turn, is regulated by the Convention On Biological Diversity (1993). These issues were analysed by S. Yeasmin *et al.* (2021). The researchers considered the main provisions of the Kunming-Montreal Global Biodiversity Framework, recently adopted and aimed at the need to preserve up to 30% of terrestrial and marine territories by 2030, using interconnected and fairly managed conservation and conservation systems. Through various methods, including a literature review and consultations with stakeholders, six favourable conditions have been identified for the successful implementation of the programme (Serrano-Ramírez *et al*., 2021). These conditions include the interaction and involvement of indigenous peoples, the establishment of clear commitments, stable financing and compliance with international legal norms, and the development of appropriate large-scale criteria for the development of monitoring reports (Cao *et al*., 2020).

The decisions made at COP on the Convention on Biological Diversity (1993) are important to the global community for several reasons. First of all, cooperation between countries is being stimulated to jointly solve biodiversity problems. The decisions taken at the COP create international obligations that force countries to work together to preserve the natural ecosystems of the entire planet. Participating countries are obliged to implement these solutions in their national legislation, which contributes to solving biodiversity problems at the local level. The COP establishes monitoring and reporting mechanisms to monitor progress towards achieving set goals and respond to changes in biodiversity in a timely manner.

The above aspects are measures for the occurrence of environmental disasters, as in Malaysia or Indonesia. It is important to consider experience and take control and regulatory measures to avoid repeating mistakes in these regions. Only through a coordinated approach and by all stakeholders can the sustainable development and conservation of natural resources in Africa and Latin America be ensured during the massive transformation of forests into oil palm plantations.

CONCLUSIONS

Thus, the expansion of palm plantations leads to a significant decrease in biodiversity, as these large-scale monocultures mainly displace natural ecosystems such as tropical forests. That is, there is a loss of the natural environment to accommodate the numerous species of flora and fauna living in these ecosystems. This pattern leads to a decrease in the level of populations of certain species or increases the level of their extinction. Notably, the ecological balance in the relevant region is disrupted as a result of the increase in the area of palm plantations, as has already begun to happen in South America or Africa, due to the destruction of natural ecosystems that perform important functions such as maintaining a high level of soil fertility, the qualitative properties of aquifers and combating countless degradation actions.

The results of this study confirm once again that the issue of conservation of biodiversity and ecosystems should be addressed and correlated with environmental policy and sustainable climate goals of the COP. That is why these solutions should stimulate cooperation between diverse management and executive sectors, and improve public-private partnerships in order to implement comprehensive measures to protect biodiversity. This cooperation will facilitate the development and implementation of regional strategies and national development programmes for the conservation of biodiversity, since the effectiveness of measures may vary significantly depending on the socio-economic, political, and environmental characteristics of the region.

In the context of further promising areas of research in the field of protection and conservation of biodiversity and ecosystems, in the context of the impact of COP decisions, it is possible to highlight the strengthening of cooperation between countries and international organisations to exchange experience, technologies, and investment projects. It is important to develop and implement alternative strategies for preserving the uniqueness of natural ecosystems in the context of sustainable forestry, the latest agroecological approaches to agriculture. It is necessary to involve the public in the decision-making process at the COP and ensure broad support for the conservation of biodiversity and ecosystems. This may include conducting public consultations, educational campaigns, and involving local initiatives in conservation work.

It should be noted that Africa and Latin America are extremely promising territories in agriculture, economic growth and the development of the energy industry. However, one of the main problems in the study of the expansion of oil palm trees in significant areas of land in the above regions is the insufficient amount of data on environmental indicators of land use, nature management, and differentiation of flora and fauna. An equally defining limitation in studying the problem of biodiversity, which is associated with the expansion of palm oil production, was the development of methods for economic and mathematical assessment of this impact, as there is no single acceptable standard for these indicators in international practice.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Оцінка впливу рішень COP на біорізноманіття та екосистеми

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Анотація. Актуальність теми обґрунтована тим, що будь-яке антропогенне навантаження, господарська діяльність впливають на функціонування природних екосистем, що демонструє поширена практика експансії олійних пальм. Метою даного дослідження було формування методів оцінки стратегій, що відіграють важливу роль у посиленні заходів з охорони біорізноманіття та екосистеми на території Африки, Латинської Америки з урахуванням впливу рішень Конференції Організації Об'єднаних Націй зі зміни клімату. У статті проаналізовано матеріали різних міжнародних організацій щодо проблем біорізноманіття, пов'язаних із кліматичними кризами, неефективним територіальним плануванням, експансією угідь для вирощування сільськогосподарських культур, що виснажують ґрунти або зменшують площі земель, необхідних для розміщення біоти. У роботі представлено послідовність кроків щодо проведення оцінки впливу рішень Конференції Організації Об'єднаних Націй зі зміни клімату на біорізноманіття та екосистеми. Обґрунтовано аспекти збереження біорізноманіття та екосистем у розрізі експансії пальмових плантацій. Проаналізовано показники співвідношення між доступною площею земельних угідь для вирощування пальмової олії та площею, що загрожує зменшенню біорізноманіття Африки. Обґрунтовано природоохоронні рішення, які співвідносяться з положеннями Конференції Організації Об'єднаних Націй зі зміни клімату в контексті збереження біорізноманіття та екосистем з урахуванням експансії великих площ для пальмових плантацій на території Колумбії. Практичне значення даного дослідження полягає у формуванні методики економіко-математичної оцінки рішень Конференції Організації Об'єднаних Націй зі зміни клімату, що впливають на збереження біорізноманіття, екосистеми та є рушійним механізмом у створенні дієвої системи контролю щодо відстеження плантацій олійних пальм, територіального розвитку з найменшими екологічними втратами і високими показниками економічної ефективності

Ключові слова: Організація Об'єднаних Націй; кліматичні трансформації; територіальне планування; природокористування; ресурсний потенціал; плантації олійної пальми