# The Relevance of Sustainable Development of Forest Resource Reproduction in Kazakhstan

Kurmankul T. Abayeva
Department of Forest Resources, Game Management and Fishery, Kazakh National Agrarian Research University

Gaukhar M. Rakhimzhanova
Department of Management and Organization of Agribusiness named after H.D. Churin, Kazakh National Agrarian Research University

Myrzabayeva, Gulnar
Faculty of Agrobiology, Kazakh National Agrarian Research University

Zhilkibayeva, Elmira
Department of Forest Resources, Game Management and Fishery, Kazakh National Agrarian Research University

他

https://doi.org/10.5109/7172209

出版情報：Evergreen. 11 (1), pp.46-55, 2024-03. 九州大学グリーンテクノロジー研究教育センター
バージョン：

# The Relevance of Sustainable Development of Forest Resource Reproduction in Kazakhstan

Kurmankul T. Abayeva[1], Gaukhar M. Rakhimzhanova[2,*], Gulnar Myrzabayeva[3], Elmira Zhilkibayeva[1], Aigerim Beisekeyeva[4]

[1]Department of Forest Resources, Game Management and Fishery,
Kazakh National Agrarian Research University, Republic of Kazakhstan

[2]Department of Management and Organization of Agribusiness named after H.D. Churin,
Kazakh National Agrarian Research University, Republic of Kazakhstan

[3]Faculty of Agrobiology, Kazakh National Agrarian Research University, Republic of Kazakhstan

[4]Department of Agrotechnology, Toraighyrov University, Republic of Kazakhstan

*Author to whom correspondence should be addressed:
E-mail: gaukhar.rakhim@hotmail.com

(Received December 07, 2023; Revised February 21, 2024; Accepted March 06, 2024).

**Abstract**: Achieving sustainable development in modern conditions is one of the main goals of the state policy of any country. One of the important components of this concept is to ensure the reproduction of forest resources, which makes it relevant to analyse the development of this component in different countries. Thus, the purpose of the study was to assess the current state of sustainable development of forest resources in Kazakhstan and formulate recommendations for subsequent state policy in this area. The main research methods were analysis, historical, and abstraction. Within the framework of the study, forest management was assessed. The conclusion was formed that the state authorities of the country form an effective policy in this sphere. This, in turn, leads to long-term development in this sphere. The evolution of the decisions of the state authorities of the country was also traced, and its emphasis and peculiarities were assessed. In order to find solutions to the problems that still remain in this area, some actions that can be applied by the state were proposed. A special emphasis was placed in the context of the problems of forest ecology and sustainable development. Statistical data characterizing the development of forests in the country were used to confirm all the conclusions drawn. This work brings new knowledge to the study of sustainable development and ecology, as well as recommendations to increase the effectiveness of public policy in the field of forestry in Kazakhstan.

Keywords: ecology; environmental protection; economy; international organizations; reforestation

## 1. Introduction

In general, sustainable development is a concept that seeks to ensure that the current needs of society are met without undermining the ability of future generations to meet their needs[1)]. It involves a balance between environmental, economic, and social sustainability to ensure long-term sustainability at all levels. Each of them implies the achievement of certain goals, within which certain indicators of the country's development will be improved. At the same time, this development will be formed not at the expense of future generations, but within the framework of the possibility of restoring natural resources. Given the imperative of minimizing negative environmental impacts for future generations, achieving a harmonious balance among social, economic, and cultural aspects becomes paramount. Consequently, significant efforts have been dedicated to pursuing sustainable development within the country, considering all the aforementioned factors.

This study examined the progress of sustainable forest reproduction in Kazakhstan. Forests play a crucial role in the country's ecosystem, supporting life within Kazakhstan. For example, forests absorb carbon from the atmosphere through the process of photosynthesis and release oxygen, so forest regeneration helps to reduce the level of carbon dioxide in the atmosphere, which is important for combating climate change. Forests serve a multifaceted purpose beyond their immediate function. Ensuring the sustainable reproduction of forests is crucial

for maintaining ecosystem balance, societal well-being, and addressing climate change. This involves preserving ecosystem equilibrium, natural resources, reducing carbon emissions, fostering employment, economic growth, and safeguarding socio-cultural heritage. Hence, conducting a comprehensive evaluation of this aspect in Kazakhstan is pertinent for further research.

A significant number of scientists have been working on the assessment of the state of sustainable development in Kazakhstan. For example, S.V. Bespalyy[1], as part of his research, provided an overview of sustainable development in the region, focusing on its environmental, economic, and social components. The scientist noted both positive and negative factors that are observed within the selected territory, as well as provided options for solving existing problems. In turn, A. Koshim et al.[2] conducted a study on how ecotourism is developing in Kazakhstan, in particular in one of its regions, "Altynemel" National Park. The researchers described the ecological state of the local environment and highlighted the problems that are causing the unsustainability of ecotourism, both in the area and in Kazakhstan as a whole. The relationship between economic growth and renewable energy sources was assessed by A. Raihan and A. Tuspekova[3),4)]. They describe the correlation between economic development and $CO_2$ consumption and the role of renewable energy sources in this interaction.

Z. Yessymkhanova et al.[5] assessed how water management has occurred and what role it has for the long-term well-being of Kazakhstan, and in particular its environmental well-being. In addition, they described recent actions taken by public authorities in this direction. In turn, the interaction between environmental development and agricultural development was noted by D. Wang et al.[6]. Scientists wrote about Kazakhstan as an important country in the international context in terms of food provision and, thus, the role of environmental security for it. The authors observe a lack of emphasis on sustainable forest development in Kazakhstan within existing literature. This underscores the importance of conducting further research in this area, given the current gap in scientific discourse on the subject.

Thus, the aim of the work was to assess the state of sustainable forest reproduction development in Kazakhstan. This will allow not only updating the available information on the ecological state of the country but will also provide an opportunity to better shape public policy in terms of achieving sustainable development goals, including in the forestry sector.

## 2. Materials and Methods

The study used information provided by selected international organizations, namely the World Bank[7]. In this context, the overall initiatives aimed at improving the sustainable development of forests in Kazakhstan, applied jointly by this organization as well as by the state authorities of the country, were described. In addition, this organization provides data describing various economic, social, and environmental indicators of the country. Within the framework of the work, data on the forest area of Kazakhstan was used. The authors also used information from the United Nations Development Programme (UNDP)[8], which also conducted joint projects with Kazakhstan in the field of protection and restoration of forest resources in the country. Also, as a source of statistical data, information from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan[9] was used, in particular – data on the volume of services provided in the field of forestry. In addition, data from Macrotrends[10] were used to estimate the inflation rate in the country. During the study, some components of the legal and regulatory framework were used, in particular – Forest Code of the Republic of Kazakhstan No. 477-II[11]. Also, the text of the Government Decree No. 878 to Approve the National Plan of Action on Hygiene of the Environment[12] was used for the purposes of the study.

The approach used was systematic. It allowed describing the factors influencing forest development in Kazakhstan as a separate system within which these indicators interact with each other. The main method used during the study was analysis. It allowed drawing conclusions about the sustainable development of forest reproduction in Kazakhstan on the basis of available information about it. In addition, the historical method played an important role, through which a retrospective assessment of the development and changes in the state of the concept of sustainable development in the country as a whole was carried out. With the help of abstraction, it was possible to ignore numerous indicators that only indirectly characterized the sustainable development of forest resource reproduction, thus increasing the accuracy of the study. Forecasting made it possible to assess the probable future development of this sphere. The components of statistical analysis were also used to assess individual indicators of the state of forest resources in the country. The comparative method made it possible to assess the data on the development of forests in Kazakhstan in different time periods and draw conclusions about the extent to which their functioning in each of them was effective. The graphical method allowed the construction of separate figures and tables for the work, which simplified the perception of the assessed data.

## 3. Results

Kazakhstan has limited forest cover, with about 4% of its territory covered by forests, including saxaul plantations (Fig. 1)[13]. The country's harsh continental climate poses challenges for forest growth and afforestation. Since independence, forestry institutions and infrastructure have been preserved, and the area of the forest fund has generally increased, which is already indicative of positive trends in this area.

The Forest Code of the Republic of Kazakhstan No. 477-II[11] provides the legislative basis for forestry and forest protection in Kazakhstan. It regulates public relations related to the possession, use, and disposal of forest resources, and establishes the legal framework for their protection, conservation, and sustainable use. The Code aims to improve the regulatory framework for forestry and forest protection, with provisions for continuous forest management and afforestation goals, such as planting two billion trees by 2026 and switching to continuous forest management by 2027[14]. The code is an essential component of Kazakhstan's environmental policy and legal framework, aiming to protect the environment in favour of human life and ensure the sustainable use of natural resources. The recent legislative developments in Kazakhstan, including the incorporation of Payments for Ecosystem Services (PES) and Biodiversity Now concepts into national legislation, reflect the country's commitment to innovative finance for biodiversity protection and sustainable forest management[15].

The reformed system of state forest management clarified responsibilities and sources of funding between different levels of executive power. It began to be financed from the Republican and local budgets, as well as from forestry organizations providing paid services. Plans for the expansion of reforestation and afforestation began to be developed and approved jointly with regional authorities, which also had a positive impact on the development of forest areas and increased the amount of work carried out on them[16]. The benefits of ensuring sustainable development of forest reproduction can be described through several main components. This description is shown within the framework of Table 1.

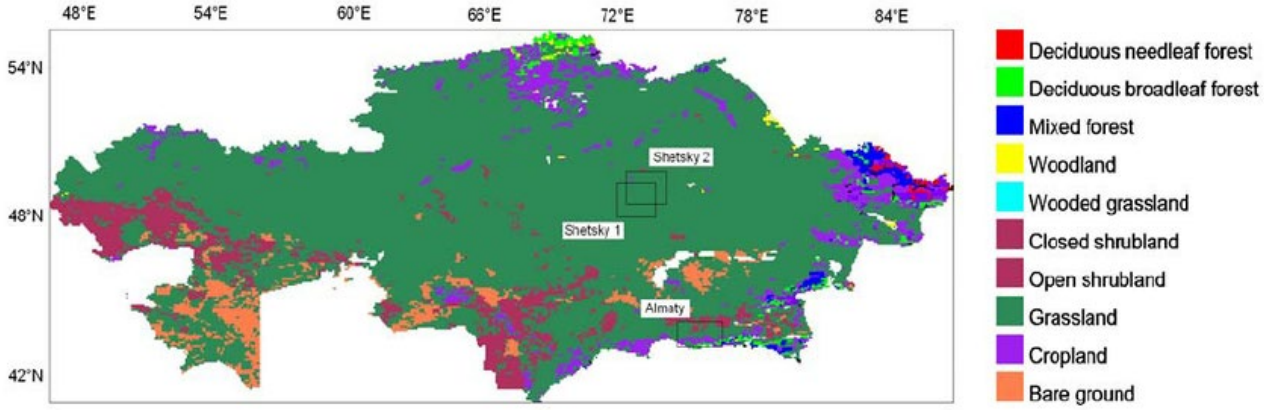


**Fig.1:** Classification of current vegetation for the Republic of Kazakhstan.

Source: [13]

Table 1. Characteristics of individual aspects of sustainable development of forest resource reproduction.

| Aspect | Characteristics |
|---|---|
| Preserving ecosystem balance | Sustainable reproduction of forest resources helps preserve biodiversity and ecosystem functions of forests. Forests act as filters for water resources, preventing soil erosion and maintaining microclimate stability. Balanced use of forests helps preserve these ecosystem services for future generations. |
| Conservation of natural resources | Forests provide resources such as timber, wild fruits, medicinal plants and many other products. Sustainable forest management ensures access to these resources in the long term, preventing their depletion. |
| Reduced carbon emissions | Forests are important carbon stores, helping to absorb carbon dioxide from the atmosphere. Sustainable development of forest resources helps to increase the area of forests and maintain them as effective tools in the fight against climate change. |
| Job creation and economic development | Forests and the wood processing industry provide jobs and contribute to regional economic development. Sustainable use of forest resources contributes to long-term stability in this area. |
| Sociocultural value | Forests have cultural and social significance for local communities. They provide a place for rest, recreation and traditional practices. Sustainable development of forest resources supports these aspects and contributes to the preservation of cultural heritage. |

**Source:** compiled by the authors.

As can be seen from Table 1, forests play a major role in the development of a country, not only in ecological, but also in economic and social terms. This, in particular, is one of the reasons why this issue has received quite a lot of attention in the current realities.

In market economies such as Kazakhstan, forestry has evolved. This is the reason why market principles have been applied to forest management. Such an approach was supposed to increase the efficiency and social utility of forests as such. It is also supported by the Forest Code of

the Republic of Kazakhstan[11], which sets out the objectives of forest management. These objectives cover the extraction of various forest resources, such as timber, resin, oleoresin, and secondary wood materials, as well as the utilization of the ecological and social functions of the forest. The Code also allows for both long-term and short-term forest management arrangements (Table 2)[17].

Table 2. Forest management activities and contracts

| Type | Activities | Duration | Award process |
|---|---|---|---|
| Long-term management | Logging, gum extraction, secondary wood materials use, hunting, research, cultural activities, recreation, tourism | 10 to 49 years | Tender and contractual |
| Short-term management | Secondary forest management, research and development, cultural/recreational/tourism activities | Variable | Arranged around other activities |

**Source:** compiled by the authors based on [17].

Forestry income is created in a variety of ways, and forest management activities are determined by a balance between private sector, government, and institutional interests. Recently, however, economic viability (most often logging) has started to play a major role, and the ecological component has started to suffer. After the transition to a market economy in Kazakhstan, reforms were implemented that allowed forestry lands to be leased commercially, leading to an increased focus on profitable logging operations. Some of the issues that have arisen include[16]:

1) Foreign and domestic companies were granted logging rights in Kazakhstan's forests through concessions and long-term contracts. Some were accused of unsustainable and illegal over-logging driven by economic motivations.
2) The weak rule of law and corruption have allowed influential companies to exploit forest resources without regard for sustainability standards or regulations.
3) Forest fires and disease/pest outbreaks have damaged ecological stability in some regions, partly connected to poor forest management practices.
4) The structure of forest administration and responsibilities between national and local bodies has undergone frequent change, hampering consistent oversight.
5) Reforestation efforts have struggled to keep pace with economic deforestation in parts of the country. Funding and incentives for ecological restoration have been inadequate.
6) Protected areas and conservation zones are limited. The drive for profits has led to the conversion of forested lands for other uses such as agriculture.

To address these issues, Kazakhstan has been working on improving its forest management framework and implementing sustainable development practices. For example, in 2018, amendments to the Environmental Code were passed to improve the monitoring, reporting, and verification (MRV) system, as well as the overall greenhouse gas emissions regulation and KETS operation. Additionally, the country has been exploring the development of community-private forestry plantations and the implementation of sustainable forest management practices[17].

To address these problems, the state can encourage wood recycling and waste utilization, as well as incentivize entrepreneurs through preferential measures for sustainable forest management[18),19]. In addition, it is relevant to find opportunities for better revenue sharing between stakeholder groups (business, society, and public authorities) to create fair and balanced forest management conditions. Although important initiatives for this have already been introduced (namely tenders and options), they can become more effective. Thus, the targeting of forest resources for companies to operate on their territories is in fact a necessary component of the country's development, but for this purpose, one needs to be vigilant about how companies operate on these territories and whether they are violating the country's basic laws on dealing with forest resources and the protection of the external country as a whole.

Due to Kazakhstan's limited forest cover, the country must pay special attention to reforestation as a strategy to counter the effects of climate change, restore biodiversity, and support local communities. The Republican Centre for Forest Breeding and Seed Production, which engages in the cultivation of valuable tree species with high genetic value and productivity, plays a crucial role in this. Branches of the centre are dedicated to the cultivation of rare species, such as Sivers apple tree and turanga[15]. It is noteworthy that the cultivation of relict turanga in the Biotechnology Laboratory has been successful, contributing to the restoration of ecosystems in desert and semidesert regions. Desertification and land degradation, affecting most of the country's land, are causing pressing environmental problems[20]. Desertification and land degradation can cause a range of pressing environmental problems. These include reduced food production, water scarcity, loss of biodiversity, food insecurity, and the spread of infectious diseases[19]. Desertification can also lead to the loss of forest cover, shortage of wood resources, and decrease in drinking water reserves due to the loss of aquifers. Land degradation and desertification can affect human health through complex pathways, including higher threats of malnutrition, water- and food-borne diseases, respiratory diseases, and the spread of infectious diseases as populations migrate. The annual cost of land

degradation and desertification is approximately 127 billion USD, and the value of lost ecosystem services caused by desertification and land degradation is estimated to be between 6 trillion USD and 10 trillion USD annually[7]. In order to prevent this from happening, it is worthwhile for government authorities to implement reforestation, manage local water resources, counter wind erosion, and take other important actions related to forest conservation. Forest reserves also play a major role in the country. Within their boundaries, various activities are carried out, including resin and sap extraction, production of secondary wood materials, auxiliary forestry (grazing, breeding, gardening), hunting, scientific research, cultural and recreational activities, and tourism.

For the purposes of forest protection, Kazakhstan attracted the support of various international organizations, in particular the World Bank[7]. The organization helped the Republic of Kazakhstan achieve better results in terms of reforestation. The partnership was aimed at cost-effective and sustainable environmental restoration and management of forests and associated rangelands. So, their joint projects involved the use of advanced technology to monitor forests for fires and other disturbances. New equipment, such as fire tools and helicopters, was adopted to combat illegal logging and forest fires[21]. Reforestation techniques and seedbeds are used for reforestation and erosion control. The project was also supposed to address issues with the Aral Sea, as planting trees and shrubs helps stabilize the dried seabed and prevents the spread of salty, toxic dust. The project itself employed quite numerous people, and the project can be considered a success. It can be assumed that the more active involvement of international organizations will solve the difficulties in the context of sustainable forest development. There are several international organizations that can be involved in solving difficulties related to sustainable forest development. These include the United Nations Food and Agriculture Organization (FAO), the United Nations Forum on Forests (UNFF), the European Timber Trade Federation (ETTF), the International Council of Forest and Paper Associations (ICFPA), and the World Business Council for Sustainable Development (WBCSD)[6]. These organizations promote sustainable forest management, strengthen long-term political commitment, and provide financial assistance and technology transfer for sustainable forest development. They also work towards reconciling conflicts between groups, assisting national governments in pursuing key policy reforms, and developing criteria and indicators for sustainable forest management[19].

Together with UNDP (2023), the project “Forests of High Conservation Value” (FHCV) was implemented in Kazakhstan, which aims to select forests in the country that require special protection and care in the processes of their activity. By identifying valuable forests and including them in the national standards, it is possible to achieve a better balance of forest management principles: economic, social, and environmental. The implementation of the FHCV concept and appropriate certification of such areas by the Forest Stewardship Council is also consistent with sustainable management of forest resources, empowerment of local communities, promotion of biodiversity conservation, and expansion of economic opportunities such as ecotourism. Kazakhstan’s diverse natural landscapes and United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites provide a strong basis for ecotourism, potentially benefiting both local communities and forest institutions. This suggests that there is potential in this concept to conserve not only forest resources but also cultural heritage.

These two international organizations formed a strategy for the protection of the environment in Kazakhstan, including forest resources – the National Environmental Action Plan[12]. The aim of this plan was to address major issues, including degradation of pastures and arable land, a lack of forests and protected areas, and biodiversity conservation. In 2002, the government transferred the functions of the Forestry Committee from the Ministry of Environment to the Ministry of Agriculture, marking a change in the role of forestry in the country[11]. Actions under the plan included adopting the concept of sustainable forest management, developing region-specific management systems, implementing pilot programmes for forest concession management, improving fire and pest protection capacity, assessing the forest resource base, increasing local reforestation efforts, and expanding training for forestry personnel. The government recognized the importance of forest protection, the need for public forest services, decentralized management in accordance with national regulations, and exploring the possibility of private forest ownership. Thus, the adoption of the NEAP and Kazakhstan’s joint initiatives with international organizations on forest protection have had a positive impact on forests, and it can be recommended to expand the scope of such cooperation in the future.

In general, the country’s success in terms of sustainable forest development can be seen in the total area planted with forests and its change. It has already been mentioned above that it is generally increasing over time. This is also confirmed by the data from the World Bank in Fig. 2.

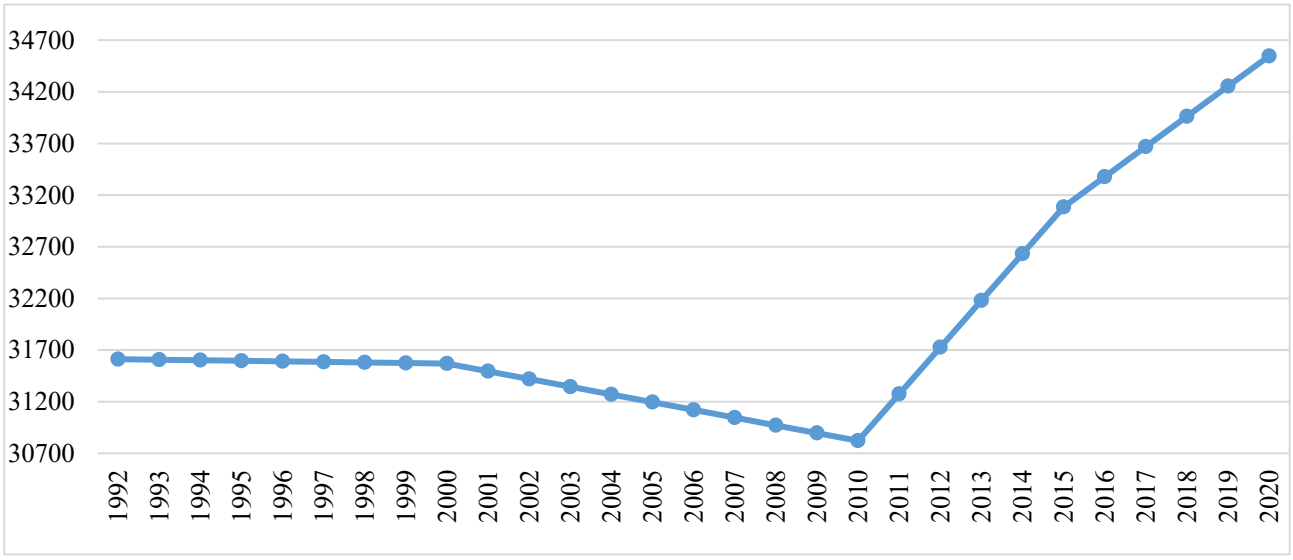


**Fig. 2:** Forested area in Kazakhstan from 1992 to 2020, km$^2$.
Source: compiled by the authors based on data from the World Bank[7)]

As can be seen from Fig. 2, the forested area in Kazakhstan as a whole declined until 2010, after which it started to increase sharply, and in 2020 was 2.8 million km$^2$ larger than in 1992. It is also possible to estimate the variables that characterize the volume of service provision in this area in the country, as shown in Fig. 3.

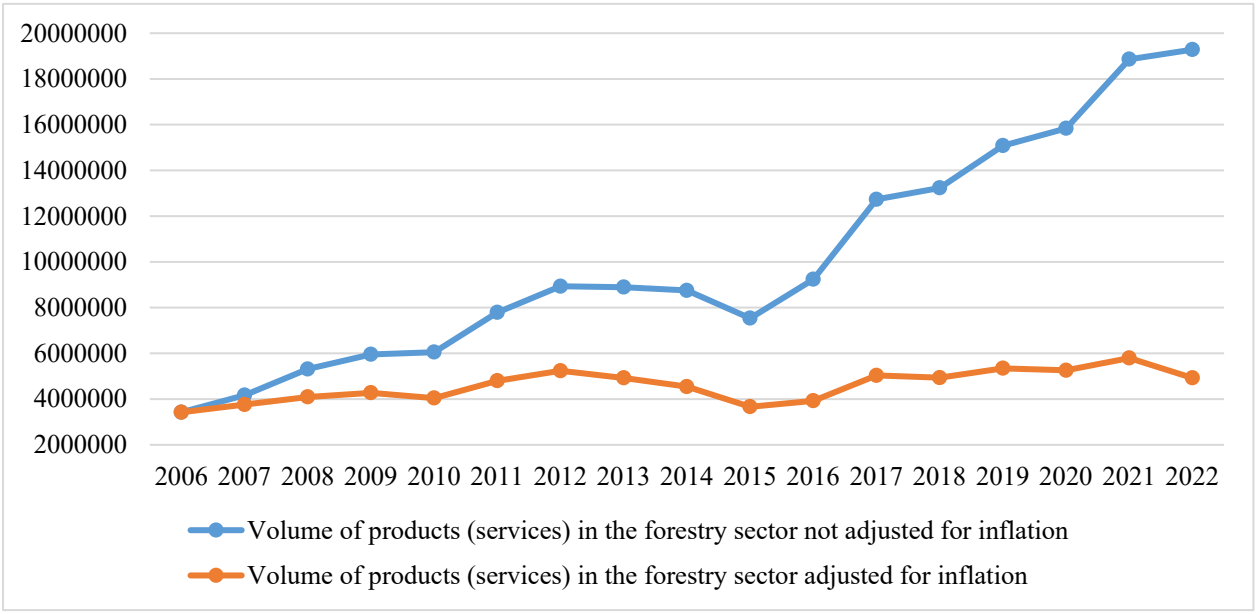


**Fig. 3:** Data on the volume of products (services) in forestry with and without inflation in the period from 2006 to 2022, thousand tenge
Source: compiled by the authors on the basis of data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan[9)], Macrotrends[10)]

As can be seen from Fig. 3, the number of services and products provided in the country has also increased significantly, both with and without inflation. Thus, it is possible to assume a generally effective policy of the state authorities regarding the protection of forests as well as their restoration and reproduction.

It is worth mentioning once again that, apart from being ecological, forests also have an economic role in the development of the country. This includes the production of raw materials for subsequent wood processing, the creation of opportunities for tourism (ecotourism in particular), and the provision of agricultural products to the population[22),23)]. Therefore, the measures taken by the state in the context of forest protection are aimed not only at environmental reasons but also at economic benefits. In recent years, Kazakhstan has improved its forest

monitoring system to include socio-economic and management indicators consistent with sustainable development goals. The country has taken steps to monitor sustainable forest management in support of the National Forest monitoring systems and assessments, which are designed to provide reliable information for improving national forest policy development, planning, and sustainable management. Key aspects of Kazakhstan's improved forest monitoring system include:

1) These indicators have been developed to reflect the economic value of forest products, the employment situation in the forest sector, and policy and legal frameworks.
2) Kazakhstan organized the 2nd National Workshop for Criteria and Indicators for Sustainable Forest Management in Astana in September 2018, where more than 30 forestry experts from Kazakhstan, Finland, and Turkey discussed the progress and challenges in sustainable forest management[1)].
3) The Joint UNECE/FAO Forestry and Timber Section, along with Georgia, Kazakhstan, Kyrgyzstan, and Uzbekistan, has been working on the development of accountability systems for sustainable forest management.
4) The Food and Agriculture Organization (FAO) has supported Kazakhstan in strengthening its capacities in designing, collecting, analysing, and reporting data from national forest inventories (NFIs) to monitor forest resources, including forest-carbon estimates, management, carbon stock, and biodiversity.
5) The United Nations Development Programme (UNDP) has been working on improving the forest, adjacent meadow, and desert resources preservation and management system in Kazakhstan[8)].

These efforts have contributed to the development of a more comprehensive and integrated forest monitoring system in Kazakhstan, which aligns with international standards and promotes sustainable forest management practices.

In particular, indicators such as the economic value of forest products and employment in the forest sector have been taken into account. In the long term, this should have a positive impact on the development of Kazakhstan's forest ecosystem. Improving the reproduction of Kazakhstan's forests will enable more active processing and production of certain types of wood products, for example, furniture. Although this industry is developing in the country, including because of the good indicators of forest development, it still faces difficulties showing itself well in the international arena. Further, state policy in the field of forestry will allow the achievement of significant positive results for furniture and other industries, thus allowing the development of the country's economy[24),25)].

## 4. Discussion

Changes caused by sustainable development in various aspects of economic life were assessed by S. Zhivkova[26)]. The scholar noted that international efforts have led to the emergence of new sectors such as environmental services, eco-production, and bio-production; quality and environmental management standards have also been established; environmental taxes have been introduced in many countries; public practices, in particular public procurement and public-private partnerships, have become more focused on sustainability. In addition, the concept of green products has emerged, which has had a significant impact on international supply chains. The research analysed highlights the emergence of new sectors such as environmental services and eco-production, as well as the establishment of quality and environmental management standards, which resonates the multifaceted nature of sustainable forest development highlighted in the authors' research. Furthermore, the introduction of environmental taxes and the emphasis on sustainability in government practice and international supply chains are consistent with the broader context of environmental protection and economic sustainability highlighted by the authors of the current study.

S.E. Iacob[27)] evaluated the role of forest resources in rural socio-economic development. The scholar notes that policymakers around the world have recently emphasized environmental health and rural development policy change, believing that the two are strongly linked. The authors agree with the idea that climate change has now become paramount, surpassing other priorities such as water management, alternative energy, energy efficiency, and biodiversity conservation. Taking this into account, the state authorities should apply comprehensive policies related to the protection of the external environment, which will significantly improve the state of development in other important areas of the state's attention. The development of forest resources is also an important component for the protection of the environment, although actions for their protection should also be taken in an integrated manner. The study resonates with the authors' findings regarding the importance of forest resources in socio-economic development, emphasizing the need for comprehensive policies to protect the environment and improve overall development.

The effective implementation of sustainable forest development was assessed in their study by D.R. Nurrochmat et al.[28)]. The scientists emphasized the need for a more appropriate and normative standard of sustainability that is reasonable, measurable, and effective. They note that the concept of "sustainability" in natural resource management is limited by nature's ability to regenerate and human adaptability, leading to a redefinition of the relationship between humans and nature in future generations. In other words, sustainability should not simply be about transferring resources and the environment to the next generation under the same conditions as in the present, but finding a way for future generations to adapt to it and also improve their standard of living[29)]. Based on this, scholars have concluded that

the success of forest development policies is significantly influenced by the rationality of socio-economic-environmental arguments, as measured by the benefits that accrue to a particular community. The reason for this is that different interests among stakeholders in resource management do not necessarily lead to conflict; hence, the solution to these difficulties lies in identifying the inherent interests of the different actors and transforming potential conflicts into opportunities for cooperation and legitimate consensus. As a result, ideas like reversibility, adaptability, rationality, and legitimacy should complement the green policy paradigm. The study resonates with the authors' findings by emphasizing the importance of a comprehensive and normative approach to sustainable forest development. It underscores the necessity of considering the long-term implications for future generations and the need for cooperation among stakeholders to address challenges effectively, aligning with the authors' discussion on the multifaceted nature of forest management and the importance of international collaboration in Kazakhstan's forestry efforts.

V.J.P.D. Martinho and A.J.D. Ferreira[30] evaluated forest governance and sustainable development in EU countries as part of their study. The literature review revealed a complex relationship between forest management, soil characteristics, water quality, ecology, ecosystem services, biodiversity, climate change, and public policies. Thus, the study found that forest management can improve soil and water quality, but unsustainable management practices can make forests more susceptible to disturbance. A correlation was also noted between forest health and a country's economic and social development. Therefore, preserving their forest quality plays a very important role in mitigating climate change. According to the researchers, public policy plays a crucial role in ensuring the sustainable development of forest areas. The authors of this study believe that it was a good idea to use Sweden as an example for such a policy. The country has demonstrated good performance related to the sustainability of forest regeneration. The study resonates with the authors' findings as it underscores the intricate interplay between forest management, environmental factors, and public policies in achieving sustainable development goals. It aligns with the authors' emphasis on the importance of effective governance frameworks, such as the Forest Code of Kazakhstan, in promoting sustainable forest management practices.

A.P. Kirilenko and R.A. Sedjo[31] assessed the impact of global climate change on forest resources. The scientists note that modelling experiments indicate that a moderate temperature increase resulting from a doubling of atmospheric $CO_2$ levels could have a positive impact on the global forest sector by increasing wood supply and potentially lowering prices. The authors of this study note that the accuracy of these models in modelling real-world forest responses is questionable due to unaccounted for limiting factors. For example, there are discrepancies between ecologists' and foresters' models regarding climate change impacts on forest products and yield projections[32]. The study supports the authors' conclusions about the multifaceted nature of sustainable forest development and the importance of international cooperation in forest conservation. At the same time, it raises doubts about the accuracy of models that predict the impact of climate change on forest resources, which calls for caution in making forestry decisions based solely on such forecasts.

A study on the transition to artificial timber sources in China was conducted by T.H. Farooq et al.[33]. They wrote that this transition is quite difficult in the country, depending largely on the implementation of the planned strategies. It comes with challenges such as declining soil fertility, disease susceptibility, loss of biodiversity, and reduced productivity. To ensure the sustainability of these plantations, scientists recommend establishing plantations on infertile lands to improve environmental conditions and enhance local biodiversity. But this requires a comprehensive understanding of the broader ecological context of forest plantations, because of which the people who subsequently implement these projects must have a high level of education and experience in the business. However, it also remains important for the scientists who form the theoretical basis for these processes. The study on the transition to artificial timber sources in China resonates with the authors' findings regarding the challenges associated with forest management and conservation efforts. Both studies underscore the importance of comprehensive strategies and a deep understanding of ecological contexts for sustainable forestry practices. The recommendation to enhance the scientific base among workers aligns with the authors' emphasis on the importance of capacity building and education in improving forest management in Kazakhstan.

Thus, the overall situation in Kazakhstan in terms of sustainable reproduction of forest resources is improving. Nevertheless, the state authorities still need to implement appropriate policies in order to maintain this trend. Based on this study, the following recommendations can be described. Firstly, focus on reforestation, in particular by supporting regional initiatives. Secondly, continue to implement the principles of the Forest Code of the Republic of Kazakhstan[11] to ensure sustainable forest management and apply the principles of the Code. Thirdly, to balance the distribution of resource among stakeholders, understand the economic feasibility of logging. In order to avoid critical negative changes in the state of Kazakhstan's forests, it is worthwhile to encourage enterprises to use appropriate forest-saving technologies (in particular, wood processing and waste utilization). It is possible to increase the efficiency of forest resources utilization through public-private partnerships, encouraging cooperation between the private sector, government, and institutional interests in forest management. International organizations can also be

involved in this process, with which Kazakhstan has already had quite effective experience. These are just some of the recommendations that can be presented to the authorities of the country. By following them, Kazakhstan can continue to improve its forest management practices, enhance their sustainability, and contribute to the well-being of both the environment and the population.

## 5. Conclusions

Kazakhstan's approach to forest management and conservation has changed significantly since independence. In general, this has allowed it to make notable progress in forestry practices. The Forest Code of the Republic of Kazakhstan has played a major role in this, which has enabled the formation of a legal and regulatory framework for forestry and forest protection. This code not only clarified responsibilities and sources of funding, but also introduced mechanisms for sustainable forest management.

The paper showed that Sustainable Forest Resource Development is a multifaceted task covering various aspects such as preserving the balance of the ecosystem, conserving natural resources, reducing carbon emissions, creating jobs, and enhancing socio-cultural value. Forests in Kazakhstan are critical to both environmental and socio-economic sustainability, offering resources, environmental services, and cultural heritage, which makes it relevant for the state to follow up on this issue to improve its capacity to protect them. International cooperation has also supported Kazakhstan's efforts to protect its forests. Initiatives with organizations such as the World Bank and UNDP have focused on reforestation, conservation, and biodiversity enhancement. The National Environmental Health Action Plan further emphasizes the importance of forest conservation and management in the broader context of environmental protection. The country's commitment to forest conservation is also evident in the expansion of forest areas, as evidenced by the steady increase in forest plantations over the years. Moreover, there has been an increase in forestry related services and products, indicating the positive impact of these endeavours on the national economy and environmental well-being.

It is relevant for future research to test the sustainable development of other ecosystems in Kazakhstan in order to find opportunities for even better public policymaking in this area. In addition, it is important to assess the activities of foreign government agencies in terms of achieving sustainable development goals in order to evaluate their experience and use it for our own purposes within the country.

### References


1) S. V. Bespalyy, "Sustainable development of a region. Case study – Kazakhstan," *J. Environ. Manag. Tour*, 12 *(2)* 529-537 (2021). doi:10.14505//jemt.v12.2(50).22.
2) A. Koshim, A. Sergeyeva, Ye. Kakimzhanov, A. Aktymbayeva, M. Sakypbek, and A. Sapiyeva, "Sustainable development of ecotourism in "Altynemel" National Park, Kazakhstan: Assessment through the perception of residents," *Sustainability*, 15 *(11)* 8496 (2023). doi:10.3390/su15118496.
3) A. Raihan, A., and A. Tuspekova, "Dynamic impacts of economic growth, energy use, urbanization, agricultural productivity, and forested area on carbon emissions: New insights from Kazakhstan," *World Dev. Sustain.,* 1 100019 (2022). doi:10.1016/j.wds.2022.100019.
4) A. Raihan, and A. Tuspekova, "Role of economic growth, renewable energy, and technological innovation to achieve environmental sustainability in Kazakhstan," *Curr. Res. Environ. Sustain.*, 4 100165 (2022). doi:10.1016/j.crsust.2022.100165.
5) Z. Yessymkhanova, Sh. Niyazbekova, Zh. Dauletkhanova, D. Satenova, S. Zhumasseitova, A.T. Kadyraliev, G.T. Supaeva, T. Dzholdosheva, and N. Dzholdoshev, "Water resources management in Kazakhstan in conditions of their shortage," *IOP Conf. Ser.: Earth Environ. Sci.*, 937 032012 (2021). doi:10.1088/1755-1315/937/3/032012.
6) D. Wang, S. Li, Sh. Toktarbek, N. Jiakula, P. Ma, P., Y. Feng, "Research on the coordination between agricultural production and environmental protection in Kazakhstan based on the rationality of the objective weighting method," *Sustainability*, 14 (6) 3700 (2022). doi:10.3390/su14063700.
7) World Bank, Forest area (sq. km) – Kazakhstan, https://data.worldbank.org/indicator/AG.LND.FRST.K2?locations=KZ (accessed November 25, 2023).
8) United Nations Development Programme, Preservation of forests of Kazakhstan for the well-being of people, https://www.undp.org/kazakhstan/stories/preservation-forests-kazakhstan-well-being-people (accessed November 26, 2023).
9) Bureau of National Statistics, Statistics of agriculture, forestry, hunting and fisheries, https://stat.gov.kz/en/industries/business-statistics/stat-forrest-village-hunt-fish/ (accessed November 27, 2023).
10) Macrotrends, Kazakhstan Inflation Rate 1994-2023, https://www.macrotrends.net/countries/KAZ/kazakhstan/inflation-rate-cpi (accessed November 28, 2023).
11) Forest Code of the Republic of Kazakhstan No. 477-II, n.d., https://adilet.zan.kz/eng/docs/K030000477_ (accessed November 29, 2023).
12) Government Decree No. 878 to Approve the National Plan of Action on Hygiene of the Environment, n.d., https://natlex.ilo.org/dyn/natlex2/r/natlex/fe/details?p3_isn=57785 (accessed November 30, 2023).
13) P.A. Propastin, and M. Kappas, "Retrieval of Coarse-Resolution Leaf Area Index over the Republic of Kazakhstan using NOAA AVHRR satellite data and

ground measurements," *Remote Sens.*, 4 *(1)* 220-246 (2012). doi:10.3390/rs4010220.

14) S. Kerimkhulle, Zh. Aitkozha, A. Saliyeva, Zh. Kerimkulov, A. Adalbek, and R. Taberkhan, "Agriculture, hunting, forestry, and fishing industry of Kazakhstan economy: Input-output analysis," in: *Proceedings of 6th Computational Methods in Systems and Software 2022, Volume 1 "Software Engineering Application in Systems Design"*, R. Silhavy, P. Silhavy, and Z. Prokopova (Eds.), Cham, Springer, 2022: pp. 786-797. doi:10.1007/978-3-031-21435-6_68.
15) S. Kerimkhulle, Z. Kerimkulov, Z. Aitkozha, A. Saliyeva, R. Taberkhan, and A. Adalbek, "The estimate one-two-sided confidence intervals for mean of spectral reflectance of the vegetation," *J. Phys.: Conf. Ser.*, 2388 012160 (2022). doi:10.1088/1742-6596/2388/1/012160.
16) S. Niyazbekova, L. Moldashbayeva, S. Kerimkhulle, N. Dzholdoshev, T. Dzholdosheva, and M. Serikova, ""Green" bonds – A tool for financing "green" projects in countries," *E3S Web of Conf.*, 244 10060 (2021). doi:10.1051/e3sconf/202124410060.
17) I. Kulbanska, H. Boiko, M. Shvets, A. Vyshnevsky, and Yu. Savchenko, "The role of aphyllophoroid macromycetes as indicators of forest ecosystem disruption and reducers of biomass accumulation," *Sci. Horiz.*, 26 *(3)* 70-80 (2023). doi:10.48077/scihor3.2023.70
18) M.W. Kleespies, and P.W. Dierkes, "The importance of the sustainable development goals to students of environmental and sustainability studies – A global survey in 41 countries," *Humanit. Soc. Sci. Commun.*, 9 218 (2022). doi:10.1057/s41599-022-01242-0.
19) Y. Tsapko, O. Bondarenko, O. Horbachova, S. Mazurchuk, and N. Buyskikh, "Research activation energy in thermal modification of wood," *E3S Web of Conf.*, 280 07009 (2021). doi:10.1051/e3sconf/202128007009.
20) T. Dibbern, and M.P. Serafim, "Sustainable development goals and the scientific community: A systematic review of the literature and the research agenda," *Res. Soc. Dev.*, 11 *(2)* e53511226241 (2022). doi:10.33448/rsd-v11i2.26241.
21) P. Berrone, H.E. Rousseau, J.E. Ricart, E. Brito, and A. Giuliodori, "How can research contribute to the implementation of sustainable development goals? An interpretive review of SDG literature in management," *Int. J. Manag. Rev.*, 25 *(2)* 318-339 (2023). doi:10.1111/ijmr.12331.
22) N. Bautista-Puig, A.M. Aleixo, S. Leal, U. Azeiteiro, and R. Costas, "Unveiling the research landscape of sustainable development goals and their inclusion in higher education institutions and research centres: Major trends in 2000-2017," *Front. Sustain.*, 2 620743 (2021). doi:10.3389/frsus.2021.620743.
23) M.Y. Gumentyk, V.V. Chernysky, V.M. Gumentyk, and M.M. Kharytonov, "Technology for two switchgrass morphotypes growing in the conditions of Ukraine's forest Steppe zone," *INMATEH – Agric. Eng.*, 61 *(2)* 71-76 (2020). doi:10.35633/inmateh-61-08.
24) V. Skliar, I. Kovalenko, I. Skliar, and M. Sherstiuk, "Vitality structure and its dynamics in the process of natural reforestation of Quercus robur L.," *AgroLife Sci. J.*, 8 *(1)* 233-241 (2019).
25) V. Skliar, K. Kyrylchuk, O. Tykhonova, L. Bondarieva, H. Zhatova, A. Klymenko, M. Bashtovyi, and I. Zubtsova, "Ontogenetic structure of populations of forest-forming species of the left-bank Polissia of Ukraine," *Baltic Forest.* 26 *(1)* 132-139 (2020). doi:10.46490/BF441.
26) S. Zhivkova, "Sustainable development and the changes is the modern economic and social life," *Eur. J. Econ. Bus. Stud.*, 2 *(3)* 52-61 (2016). doi:10.26417/ejes.v6i1.p52-61.
27) S.E. Iacob, "The role of the forest resources in the socioeconomic development of the rural areas," *Proced. Econ. Fin.*, 23 1578-1583 (2015). doi:10.1016/S2212-5671(15)00415-3.
28) D.R. Nurrochmat, M.A.K. Sahide, and M.R. Fisher, "Making sustainable forest development work: Formulating an idea for a more appropriate Green Policy paradigm," *Front. Environ. Sci.*, 10 783718 (2022). doi:10.3389/fenvs.2022.783718.
29) O. Jaupaj, A. Doko, A. Dervish, F. Kadria, and K. Zaimi, "Assessment of wildfires forecast performance in Albania: Case study," *Sci. Horiz.*, 26 *(9)* 143-152 (2023). doi:10.48077/scihor9.2023.143.
30) V.J.P.D. Martinho, and A.J.D. Ferreira, "Forest resources management and sustainability: The specific case of European Union countries," *Sustainability*, 13 *(1)* 58 (2021). doi:10.3390/su13010058.
31) A.P. Kirilenko, and R.A. Sedjo, "Climate change impacts on forestry," *PNAS*, 104 *(50)* 19697-19702 (2007). doi:10.1073/pnas.0701424104.
32) S. Hradchenko, and M. Pikovskyi, "Efficiency of biological preparations against scab and powdery mildew of apple trees," *Plant Soil Sci.*, 14 *(4)* 76-85 (2023). doi:10.31548/plant4.2023.76.
33) T.H. Farooq, A. Shakoor, X. Wu, Y. Li, M.H.U. Rashid, X. Zhang, M.M. Gilani, U. Kumar, X. Chen, and W. Yan, "Perspectives of plantation forests in the sustainable forest development of China," *iForest Biogesci. Forest.*, 14 *(2)* 166-174 (2021). doi:10.3832/ifor3551-014.