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University of Gdansk, Poland

*CORRESPONDENCE
Krystyna Kurowska,
krystyna.kurowska@uwm.edu.pl

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Declining interest in afforestation under the common agricultural policy. Evidence from Poland and Lithuania

Hubert Kryszk[1], Jolanta Valčiukienė[2], Daiva Juknelienė[2], Anna Mazur[3] and Krystyna Kurowska[1]*

[1]Department of Land Management, Faculty of Geoengineering, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland, [2]Department of Land Use Planning and Geomatics, Faculty of Engineering, Vytautas Magnus University Agriculture Academy, Kaunas, Lithuania, [3]Department of Landscape Architecture, Faculty of Agriculture and Forestry, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland

Land afforestation is an important aspect of forested land development. Increasing the area of forest areas through the reforestation of uncultivated, abandoned or agriculturally unsuitable land is considered an important way to diversify economic activities in order to reduce dependence on agricultural activities and improve environmental conditions in rural areas. The main objective of the study is to identify the factors affecting the afforestation of agricultural land carried out in the years 2004–2020 by farmers under the individual financial perspectives of the Rural Development Programme (RDP) in Poland and Lithuania. The study included a review of Polish and Lithuanian regulations aimed at providing financial support for afforestation under the RDP. Moreover, a comparative analysis of the rules and criteria for financial support for afforestation in relation to selected socio-economic indicators of the two countries was carried out. Based on the study results, it can be clearly stated that in both Poland and Lithuania, the support for afforestation under the RDP fails to meet the beneficiaries' expectations. It would, therefore, be advisable to adapt the Programme to the changing economic conditions and keep the afforested land under the RDP under technical supervision. Support for afforestation should be continued to ensure the improvement in land use and the enhancement of the prospects for long-term economic activity in rural areas as well as to implement the assumptions of the green economy.

KEYWORDS

agricultural land, afforestation, common agricultural policy, forest policy, green economy, rural development programme

1 Introduction

In Central Europe, a clear human influence on the forest became evident around the 5th millennium BC with the spread of agriculture and a settled lifestyle (Krawczyk et al., 2021). Currently, forests and other wooded areas cover more than 43.5% of the EU's land area and are essential for human health and wellbeing. Forests are vitally important to us because of their impact on the air we breathe and the water we drink, and due to their rich biodiversity and unique natural system, they provide home and habitat to most species found on land around the world. Not only do they provide a place where humans can feel close to nature

and enhance their physical and mental health, but they are also essential to maintaining dynamic and thriving rural areas (New EU Forest Strategy for 2030, 2021).

Currently, the greatest concerns for all users of space worldwide include the overexploitation of forest resources and the trend towards decreasing the area of forests. Forests have long served an extremely important role in the country's economy and are vital to society (they provide job creation, food, medicines, materials, clean water, etc.). For centuries, forests have been a thriving centre of cultural heritage as well as craftsmanship, tradition and innovation. In the past, the forests were important, and they are of crucial importance for our future. Forests are naturally conducive to adapting to and combating climate change and will contribute significantly to Europe becoming the first climate-neutral continent by 2050 (New EU Forest Strategy for 2030, 2021). Kaliszewski (2018) also draws attention to the "state forest policy" that has recently been most focused on the current European forest policy priorities.

The policy of increasing the forest cover at different levels in individual countries is determined by the forest cover of the particular territory, land use traditions, links between forms of ownership, legal practice, administration, geographical features of territories, as well as other factors. In countries with few forests (e.g., United Kingdom, Iceland), programmes for increasing forest cover are being implemented more at a regional level. As the expansion of urbanised areas in Western Europe continues, increasing attention is being paid to the planning of forests and green spaces in these areas (Konijnendijk, 2001). In comparison with the neighbouring countries (Latvia, Estonia, Belarus, Sweden, Finland and Germany), the forest cover of Poland and Lithuania is one of the smallest (Riepšas, 2002). It is worth noting that Lithuania's forest cover is 3% higher than that of Poland. Changes in the economic and land ownership systems in the Baltic States (mainly Latvia, Lithuania and Estonia), from the centrally planned economy to the Soviet Union to the free market and private ownership of modern, newly independent states, have had a considerable impact on land use, especially the balance between forestry and agriculture. In all of the Baltic States, large areas of agricultural land have been abandoned and made available for afforestation over the past decades (Jõgiste et al., 2015).

Recently, there has been much controversy in Poland, as well as in other EU countries, over the European Green Deal (EGD), under which the forest policy is one of the key policies of the EU's environmental reform package. The EGD's main emphasis is on the afforestation of agricultural land, especially soils of low valuation classes, characterised by low suitability for crop production. The EGD will enable Europe to become climate-neutral by 2050. Therefore, one of the priorities of the EU's environmental policy is to promote afforestation, i.e., the establishment of forest plantations on non-forest land, areas unsuitable for agricultural production, or uncultivated land. This takes on particular importance at this time of progressing climate warming and its evident irreversible consequences. Another important document is the New EU Forest Strategy for 2030 (NFS, 2021), which is part of the European Green Deal (EGD), and builds on the Biodiversity Strategy for 2030 (European Commission, 2020), aims to increase afforestation and improve forest health and resilience, as well as exploit the potential of forests which play an important role in the ecosystem. This will be implemented through, *inter alia*, soil protection (mainly against erosion), a reduction in air pollution, involvement in the hydrological cycle, and work for the benefit of the climate (especially through carbon storage). Sierota and Miścicki (2022) predict that the new EU Biodiversity Strategy for 2030 will implement a programme of planting one billion trees with appropriate consideration given to the potential of forests, based on sustainable management principles and the assumption that the future climate will be neutral.

The Common Agricultural Policy (CAP) is the EU's largest programme that distributes approx. 40% of the EU budget to problem areas. Since its introduction in 1962, the CAP has aimed to provide subsidies and programmes to develop agriculture and rural areas. In various periods, different EU Member States had uncommon political priorities. Some of them were more focused on sustainable agriculture, environmental protection or biodiversity, which could have led to less afforestation on new land. EU grants also varied from country to country, affecting the motivation to implement afforestation. Afforestation of agricultural land is one way to develop land of marginal importance for agriculture and is a key measure to achieve the objectives of the National Forest Cover Augmentation Programme. The goal of this program is to increase the forest cover in Poland and optimise land use in accordance with the diverse needs and possibilities of individual regions of the country (Sioma, 2019).

Poland pinned high hopes on increasing its forest cover to 30% by 2020. In the first years of EU membership, there was indeed a great deal of interest in afforestation programmes, which, however, declined in subsequent years. The situation was somewhat different in Lithuania. The European Union comprises countries with very diverse geographical and climatic conditions, which affects their capability to carry out afforestation. For example, Scandinavian countries have a naturally high forest cover but do not allocate additional land for new forests. In contrast, southern European countries such as Spain or Greece may have limited opportunities due to natural and climatic conditions (Mason et al., 2022). Therefore, two neighbouring countries, Poland and Lithuania, were chosen as the study area. It is also worth noting that both countries share similar historical, natural and climatic conditions and joined the EU at the same time.

After 20 years of Poland's and Lithuania's membership in the European Union, it is worth summarising the measures taken to date to increase the forest cover levels of both countries. Therefore, the identification of the factors affecting the afforestation of agricultural land since 2004 by farmers under the different financial perspectives of the Rural Development Programme in Poland and Lithuania, i.e., in the years 2004–2006, 2007–2013 and 2014–2020, was adopted as the main objective of the study.

2 The implementation of afforestation in Poland and Lithuania to date

Land use in Poland and Lithuania has changed over time. Agricultural land has always been the dominant form of land management. In Poland, moderately fertile and poor soils prevail, which may favour a change of land use to a non-agricultural one. Lithuania is located in a forest zone, where the natural state of the

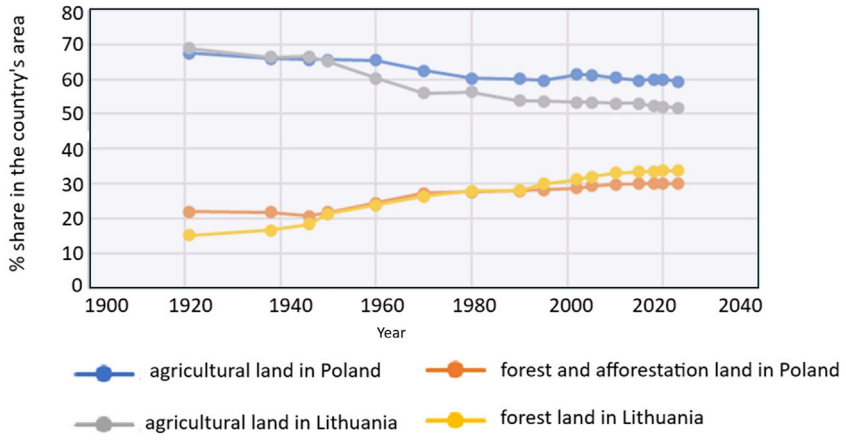

FIGURE 1
The percentage of agricultural land and forests in the total area of the country in Poland and Lithuania in the years 1921–2022.

territory is the forest. However, over time, as a result of human economic activities, Lithuania's forest cover has decreased, and a very uneven forest cover has been established in the country's individual regions, which is related to the fertility of agricultural land. Changes in the percentage of the total area of agricultural land as well as forests and woodlots in the individual years are provided in the graph below (Figure 1).

In Poland, in the past, due to socio-economic processes, mainly the expansion of land for agricultural use, the forest cover decreased to 38% in 1820 and to 20% in 1938. In 1945, the forest cover in Poland accounted for 20.8% (National Forest Cover Augmentation Programme, 2003). Compared to other European countries in which the forest cover was approx. 30%, an increase in the forest cover in Poland has become an objective necessity (Smykala, 1990). In the years 1945–2000, the area of forests and land associated with forest management increased from 6,470 thousand ha to 9,059 thousand hectares, i.e., by 40.0%. During the period, the country's forest cover increased from 20.8% to 28.4%. The greatest volume of afforestation works was noted in the 1960s (with up to 60 thousand ha afforested per annum) (Biczkowski and Rudnicki, 2013; Kurowska et al., 2014). Afforestation carried out on such a huge scale was not solely determined by the agricultural unprofitability of the land under consideration. At the time, the allocation of specific areas for afforestation was determined by the huge supply of undeveloped land (Sobczak, 1996). In the 1980s, interest in afforestation declined as a result of the development of a stable basis for agricultural policy and the equal treatment of all agricultural sectors in Poland (Smykala, 1990). As demonstrated by Szujecki (2003), approx. 30% of Polish forests grow on land that was deforested and then used for agricultural purposes or left fallow. In Poland, there is a large variation in the forest cover between regions, ranging from 20% to 50% (Wysocka-Fijorek et al., 2020a). Biczkowski et al. (2024) also draw attention to the large variation in the needs of wooded areas in the country.

The literature on the subject has repeatedly emphasised the development of forest protective functions in the historical context, both in Poland and in other European countries (Parviainen and Frank, 2003; Referowska-Chodak and Kornatowska, 2021). An example here is an analysis by Zajączkowski (2003), who discusses the importance of forest management principles in developing the sustainable multifunctionality of Polish forests and forestry. The author points out that forests play an important role in protecting biodiversity, regulating the climate, and preventing soil degradation (Zajączkowski, 2003). Klocek (2005) draws attention to the economic aspects of managing multifunctional forests and indicates the difficulties in reconciling different functions of forests, e.g., timber production, nature conservation and recreation. The author emphasises that the development of multifunctional forests requires trade-offs between these functions which involve economic challenges. On the other hand, Wiśniewski (2015), in a study on the anti-erosion function of soil-protective forests, draws attention to the crucial role of forests in preventing soil erosion. The author points out that soil-protective forests provide important ecological functions that are essential for maintaining the health of ecosystems and protecting water and soil resources.

In the present century, the increase in the area of forests in Lithuania has been modest and is largely due to the afforestation of agricultural land. More detailed forest cover indicators for Lithuania were analysed by Professor P. Matulionis (1930), Lukinas (1968), Karčiauskas (1971), Eitmanavičienė (1976), Karazija (1979), Karazija (1988), Pauliukevičius (1982), Pauliukevičius and Kenstavičius (1995), and others. According to the State Forests data, in 1956, the forest cover in Lithuania was 19.7%, in 1966–22.6%, 24.6%, and in 1983–27.9%. Before Lithuania regained its independence in 1990, the country's forest cover was 28.5%. Later, after regaining independence in the year 2000, the forest cover showed an increasing trend. In 2017, it was already at a level of 30.9% (Ivavičiūtė, 2018; Tiškutė-Memgaudienė and Tiškutė-Memgaudienė, 2021). According to the data of the Land Fund of the Republic of Lithuania, in 2023, the country's forest cover was as high as 35.7%.

In 1995, Poland adopted the document National Forest Cover Augmentation Programme, which aimed to increase the area of forests in the country. The programme was updated in 2003 and 2014. According to its assumptions, Poland's forest cover was to increase to 30% in 2020 and to 33% by 2050. It can be said that Poland has been consistently meeting its targets, yet the prospect of

33% in 2050 poses an enormous challenge (Daniłowska, 2019; Kurowska et al., 2020; Kaliszewski and Jabłoński, 2022).

Before its accession to the European Union, Poland had a diverse system of financing afforestation works. State-owned land was afforested by the State Forests with the State Forests National Forest Holding's own funds. The extent of afforestation under implementation depended largely on the amount of funds allocated annually for this purpose in accordance with the adopted forest management policy. In addition to subsidies from the budget, afforestation of private land was supported by funds from Voivodeship Funds for Environmental Protection and Water Management and, to a small extent, by funds from the State Forests in the form of free allocation of seedlings. Between 2002 and 2004, a new system of financing afforestation of agricultural land was applied pursuant to the Act on the allocation of agricultural land for afforestation (Kurowska et al., 2014; Kurowska and Kryszk, 2017).

In Poland, under the RDP, the largest areas of land that were afforested were located in the areas where State Agricultural Enterprises predominated (with a large amount of potential land eligible for afforestation) (Kurowska and Kryszk, 2017). After 2006, there was a sharp decline in the area of afforestation in Poland as a result of a change in the criteria for allocating private agricultural land for afforestation and competition from agricultural subsidies. An equally considerable decline in the volume of afforestation was observed in the State Forests, which was due to a reduction in the area of former agricultural land and wasteland allocated for afforestation by the Agricultural Property Agency (currently the National Centre for Agricultural Support) (Banach et al., 2017; Wysocka-Fijorek et al., 2020b).

Lithuania's forest policy is developed in accordance with the Constitution of the Republic of Lithuania and other legislation. One of the most important tasks of forest policy in Lithuania is to increase the forest cover, which is determined by a combination of legal, organisational, socio-economic and ecological-environmental factors. In Lithuania, before its accession to the European Union, significant areas of agricultural land not used for agricultural purposes were a major problem. In recent decades, the area of abandoned and uncultivated agricultural land has been increasing. Such a trend emerged mainly as a result of the land reform and the adaptation of the agricultural sector to free market conditions. As a result, some agricultural land unsuitable for cultivation has been abandoned, and rapid, uncontrolled renaturalisation processes have commenced on it (Ribokas and Rukas, 2006; Ribokas and Milius, 2001). The process of agricultural land renaturalisation is most often observed in areas less favourable for agriculture, where the largest area of unproductive land is located, and hilly and naturally sensitive areas are predominant. In these areas, the efficiency of agricultural production is significantly lower than the national average.

One of the major factors leading to an increase in forest cover in both Poland and Lithuania has been the integration with the European Union and the possibility of obtaining support from the EU's structural funds. In Lithuania, the main factors determining the extent of afforestation under the RDP include the large area of unproductive abandoned and degraded land, the need to improve ecological and environmental conditions, and the creation of new jobs (Lietuvos kaimo plėtros 2004–2006 metų planas, 2004). By 2004, the largest areas were afforested by the forestry authorities (Lithuanian State Forests). Since 2004, EU funds have been allocated for afforestation. In Lithuania, the establishment of new broad-leaved and mixed forests is the priority (Šepetienė et al., 2014). A forest scenario modelling study and a qualitative analysis of users' needs in Lithuania (Juknelienė et al., 2024) confirmed the diverse perspectives, wishes, visions and intentions of key Lithuanian entities involved in forestry with regard to the goals, tasks and core functionality of forest scenario modelling tools.

Increasing the country's forest cover is a complex process, and without the afforestation of marginal land owned by farmers, it will be difficult to meet the Polish objectives of the National Forest Cover Augmentation Plan by 2050 and implement Lithuania's afforestation policy of achieving 38% in 2050. It is, therefore, advisable to adapt the existing programmes and search for support mechanisms that respond to the needs of the national policy implementation. The structure of forest ownership in Poland and Lithuania is not without significance. It is worth noting that in Lithuania, private ownership of forests accounts for approx. 50% (Juknelienė et al., 2015), whereas in Poland, it accounts for less than 20% (Źróbek-Różańska et al., 2014).

3 Methodology

After 20 years of the membership of Poland and Lithuania in the European Union, it is worth summarising the measures taken to date to increase the countries' forest cover indicators. Therefore, the identification of the factors affecting the afforestation of agricultural land since 2004 by farmers under the individual financial perspectives of the Rural Development Programme in Poland and Lithuania, i.e., in the years 2004–2006, 2007–2013, and 2014–2020, was adopted as the main objective of the study. In order to fulfil this objective, the following specific objectives were envisaged:

- A comparative analysis of the criteria for applying for afforestation support in Poland and Lithuania.
- A comparative analysis of the financial conditions of afforestation under the individual RPD financial perspectives in Poland and Lithuania.
- A balance of completed afforestation operations under the RDP, taking into account completed afforestation operations (the area by country in particular years) and the support received for afforestation (new commitments as well as commitments from the previous perspective – maintenance premium and afforestation premium).
- The identification of the internal factors (national legislation, development strategies) and the external factors (EU legislation and EU membership obligations).
- Financial and statistical analysis of the level of expenditure on afforestation in the years 2004–2022 in Poland and Lithuania, as compared to the EU.
- Recommendations aimed at increasing the volume of afforestation works, especially on land of little use for agricultural production.

TABLE 1 A comparative analysis of agricultural land afforestation under the particular financial perspectives in Poland and Lithuania.

Specification	Poland	Lithuania
RDP 2004–2006		
Title of the action	Afforestation of agricultural land and of non-agricultural land	Agricultural land afforestation
Afforestation payment period	20 years	20 years
Land eligible for afforestation	land used as arable land, permanent meadows, pastures or orchards	Agricultural land in good agricultural condition
Beneficiaries	Farmers – natural persons	Farmers or associations, and others
Minimum/maximum area requirements	A minimum area of 0.3 ha; no maximum area restrictions	A minimum area of 1 ha; an exception where newly afforested land borders an existing forest, no area-related restrictions
Payment types *	Support for afforestation (a one-off payment) Maintenance premium (5 years) Afforestation premium (20 years)*	Afforestation allowance (a one-off payment) Maintenance and protection allowance (5 years) Compensation for loss of income (20 years)*
Total budget	EUR 84.7 million	EUR 24.05 million
RDP 2007–2013		
Title of the action	Afforestation of agricultural land and of non-agricultural land	The first afforestation of agricultural land and the first afforestation of non-agricultural land
Afforestation payment period	15 years	15 years
Land eligible for afforestation	Land used as arable land and orchards, located outside Nature 2000 sites	land in good agricultural and environmental condition
Beneficiaries	Natural or legal person, or a group of natural or legal persons	Natural or legal persons owning agricultural land and state forest land managers
Minimum/maximum area requirements	A minimum area of 0.5 ha; a maximum area of 100 ha	None
Payment types *	Support for afforestation (a one-off payment) Maintenance premium (5 years) Afforestation premium (15 years)*	Afforestation allowance is paid in the first or second year after afforestation (a one-off payment) Annual allowance for the maintenance and protection of a newly planted forest (5 years) Annual allowance per hectare to compensate for loss of agricultural income following afforestation (15 years)*
Additional criteria, division into schemes	Yes Scheme I - afforestation of agricultural land Scheme II - afforestation of non-agricultural land	Yes 1. Afforestation of agricultural land afforestation of non-agricultural land 2. Afforestation of non-agricultural land - Short-rotation plantations from 6 to max. 15 years
Total budget	EUR 84.7 million	EUR 24.05 million
RDP 2014–2020		
Title of the action	Support for afforestation and establishment of afforested areas RDP 2014–2020	Investments in the development of forest areas and improvement of forest vitality
RDP 2014–2020		
Afforestation payment period	12 years	12 years
Land eligible for afforestation	land registered as agricultural areas or woodland/bushland on agricultural areas	Agricultural land in good agricultural condition
Beneficiaries	Farmers – land owners, local government units (LGU)	Farmers
Minimum/maximum area requirements	A minimum area of 0.1 ha; a maximum area of 20 ha	None

(Continued on following page)

TABLE 1 (*Continued*) A comparative analysis of agricultural land afforestation under the particular financial perspectives in Poland and Lithuania.

Specification	Poland	Lithuania
Payment types *	Support for afforestation (a one-off payment) Maintenance premium (5 years) Afforestation premium (12 years)*	Afforestation allowance is paid in the first or second year after afforestation (a one-off payment) Annual allowance for the maintenance and protection of a newly planted forest (5 years) Annual allowance per hectare to compensate for loss of agricultural income following afforestation (12 years)*
Additional criteria	Criteria for the selection of afforestation operations – a minimum of 6 points	Criteria for the selection of afforestation operations – a minimum of 30 points
Total budget	EUR 301 million	EUR 81.6 million

The analysis covered the afforestation measures taken to date in Poland and Lithuania. In order to define recommendations for future action aimed at implementing afforestation on marginal land that is not very suitable for agricultural production, a comparative analysis of the criteria and conditions for financial support was carried out. This is important in terms of both implementing the national policies of Poland and Lithuania and fulfilling the established objective of achieving climate neutrality by 2050 in the European Union countries.

The analysis was based on the data obtained from the Department for Direct Payments of the Ministry of Agriculture and Rural Development in Poland and Lithuania. The data covered the payments disbursed to beneficiaries that implemented the measure called Afforestation of agricultural and other agricultural lands within the frameworks of the RDP as of 31 December 2022. The Regional Databank data made available by the Central Statistical Office and also those contained in the yearbooks prepared by that Office were used for analyses.

4 Results and discussion

4.1 A comparative analysis of the land afforestation programme and financial conditions under the RDP in Poland and Lithuania

Poland and Lithuania are two countries with similar forest cover. However, the structure and dynamics of changes in the forest resources of both countries show some differences. Below is a detailed comparison based on the data from Table 1.

Since 2004, Polish and Lithuanian farmers have been able to afforest agricultural land, for which they receive support from EU funds under the Rural Development Programme. Over the years, the formal requirements (especially those concerning the minimum/maximum area and land eligibility for afforestation), as well as the rules for financial support, have changed. Basic information on the eligibility rules for afforestation entities and afforestation activities in Poland and Lithuania is provided in Table 1 below.

In Poland, the most favourable conditions were in the first financial perspective, i.e. 2004–2006. The most appealing component of the system was the compensatory premium, as it guaranteed income for 20 years. Similar opinions were also expressed in other countries, such as Spain (Vadell et al., 2019; Segura et al., 2021). In subsequent years, the afforestation premium payment period was reduced from 20 to 15 years. In the years 2014–2020, this payment period was reduced to 12 years (Kurowska and Kryszk, 2017). The actual area that could potentially have been used for afforestation is not without significance. In the years 2004–2006, the requirements were the most liberal. At that time in Poland, there were no area-related restrictions on the area under afforestation (Plan, 2004). Subsequent perspectives introduced area-related restrictions for one beneficiary for up to 100 ha and then for up to 20 ha. The Polish state, having noted the lack of interest in afforestation with area-related limits of up to 20 ha, responded by raising this limit again to 100 ha. In the years 2014–2020, financial support could be provided to afforested areas of up to 20 ha. An additional restriction was the introduction of point-based criteria for qualifying land for afforestation. The applications eligible for the afforestation procedure were those for which the land scored a minimum of 6 points. It is worth noting that the point-based criteria focused on environmental aspects (e.g., areas to be afforested located in ecological corridors, adjacent to surface waters, and bordering the existing forests). As a result, relatively few afforestation works were carried out in Poland under the financial perspective of 2014–2020, compared to previous periods. It is worth noting that economic conditions also changed to the detriment during this period, including, *inter alia*, an increase in the value of agricultural property, including that of poor quality (Klepacka, 2020), an increase in the price of forestry work services, and an increase in the price of planting material) (Kurowska and Kryszk, 2017).

In Lithuania, private landowners also started afforestation works in 2005, after the launch of the Rural Development Programme for the years 2004–2006. In the following years, i.e., from 2007 onwards, Lithuanian forestry received significant support from the European Union under the Lithuanian Rural Development Programme for the years 2007–2013 and 2014–2020. Thanks to the utilisation of the above-mentioned support funds, several thousand hectares of new forests were planted every year in Lithuania. The owners received a fixed payment for the planted forest and could choose whether to carry out the forest planting works by themselves or contract them with others. Compared to 2004–2006, in subsequent payment periods under the programme, the financial support also increased significantly. According to the Ministry of Agriculture data, afforestation of agricultural, non-agricultural and agriculturally abandoned land has increased by as much as six times, having received support from European Union programmes. In Lithuania, as in Poland, a point-based assessment was also introduced to qualify

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TABLE 2 Forms of financial support for afforestation and payment rates in Poland under the individual financial perspectives.

Financial perspective	2004–2006		2007–2013		2014–2020	
1 ha per year EUR						
Form of support	Coniferous tree species	Broad-leaved tree species	Coniferous tree species	Broad-leaved tree species	Coniferous tree species	Broad-leaved tree species
Support for afforestation	1000.0	1163.0	1074.0	1218.0	1524.0	1664.0
Maintenance premium	98.0		98.0		98.0	
Protection against game (2 m high metal mesh fencing)	560.0		603.0		2.0 EUR/running metre	
Afforestation premium	- an agricultural producer receiving at least 20% of their income from agriculture – 326.0 - an agricultural producer receiving less than 20% of their income from agriculture – 84.0		- an agricultural producer receiving at least 25% of their income from agriculture – 367.0		283.0 + SAP	

TABLE 3 Forms of financial support for afforestation and payment rates in Lithuania under the individual financial perspectives.

Financial perspective	2004–2006		2007–2013		2014–2020	
In EUR per ha per year						
Form of support	Coniferous tree species	Broad-leaved tree species	Coniferous tree species	Broad-leaved tree species	Coniferous tree species	Broad-leaved tree species
Forest planting allowance	1009.0	1548.0	A min of 1360.8	A max. of 4082.4	A min of 1370.0	A max. of 3796.0
Maintenance and protection allowance for an established forest	On average, 250.0		On average, 500.0		On average, 280.0	
Compensation for loss of income	For farmers and associations 72.40–147.7 For other private individuals or legal persons: 18.10–36.92		for farmers: 111.0, for other applicants: 25.0		for farmers: 171.0	

land for afforestation. However, Lithuanian assessments focused on both the species structure of newly established forests and the allocation of agricultural land for afforestation, where there were difficulties in agricultural cultivation (e.g., agricultural land with steep slopes, supplementation of forest enclaves, and priority given to communes where the afforestation rate was lower than the national average of 33.3%).

During the first period in Lithuania, the amount of support for the forestry sector was about 10% of the total support for the development of rural areas. In the subsequent years, financial support for planting new forests was reduced. Between 2014 and 2020, the proportion of support for forestry decreased by 24% and accounted for 6.6% of the rural development budget (in the years 2007–2013, it accounted for 7.5%). In Poland, the expenditure for afforestation in the RDP structure was considerably lower than that in Lithuania. In the years 2014–2020, 2.2% of the total RDP budget was allocated for afforestation, which was the lowest support compared to that in the previous periods. Between 2007 and 2013, this expenditure accounted for 3.2% (representing 26% of the planned budget for afforestation), and under the first perspective, 2.7% of the total budget was spent. It is worth noting, however, that Poland and Lithuania joined the European Union on 1st May 2004, and, therefore, the period was shortened as compared to the old EU (EU-15).

It is also worth comparing the limits of support for afforestation in the analysed countries under the individual financial perspectives. Payment rates are provided in the Tables 2, 3 below.

The analysis of afforestation programmes in Poland and Lithuania under the Rural Development Programme in the years 2004–2020 confirms that each country has adapted the requirements to its own conditions and needs. The greatest effects were obtained during the first mentioned period, which was associated with the most favourable financial support. As Sioma (2019) emphasises, with the contribution of public funds, approx. 72.4 thousand ha of privately owned agricultural land were afforested between 2004 and 2013, resulting in a significant increase in the area of private forests, which are an important organisational and functional component of agricultural farms in Poland. Despite ambitious targets for subsequent years, interest in afforestation has declined, mainly due to overcomplicated procedures (Kaliszewski et al., 2016) and insufficient incentives for farmers. The analysis revealed numerous challenges in the implementation of afforestation programmes, including high competition between direct payments for agricultural production and afforestation premiums, which lowered interest in the latter. In addition, increasing the minimum area of plots eligible for afforestation and the exclusion of permanent grassland from the afforestation programme represented significant barriers. The effectiveness of the

programmes was, therefore, variable, which suggests the need for further research and potential modifications to their structure and management.

Despite the implementation of measures to increase the country's forest cover, a reduction in the forest cover has been observed in many regions. Prusinkiewicz et al. (1983) predicted that forest areas would increasingly shrink as a result of growing pressure from industry, spatial development of cities and settlements, or investments related to the construction of technical infrastructure. Kurowska et al. (2014) demonstrated that 29 districts of the country have experienced a slight decrease in the forest cover. This phenomenon is most evident in Małopolskie Voivodeship, Łódzkie Voivodeship, and the southern part of Mazowieckie Voivodeship. After 2004, when Poland became a beneficiary of EU funds, a significant proportion of agricultural land was allocated for the construction of new road infrastructure and, starting in 2016, also the construction of railway infrastructure. As regards forest land, the actual change of their intended use for other purposes has been counterbalanced by the state policy of increasing the country's forest cover being implemented, especially on land that is least suitable for agricultural production (valuation class V and VI) (Kurowska et al., 2020).

As regards the EU policy, under the common agricultural policy (CAP), financial support for forests and forest management is provided through national rural development programmes, in particular those aimed at adapting to and increasing resilience to climate-related risks. Between 2014 and 2020, EUR 6.7 billion of the CAP forestry measures were allocated to support EU strategic objectives, in particular, afforestation (27%), forest fire and disaster prevention (24%), and investments in resilience building as well as ecological and social functions (19%). However, the level of implementation of forestry measures is low and has declined significantly over the programming period. This is due, for example, to the lack of knowledge needed to manage the administrative procedures associated with applying for access to funding, coupled with an insufficiently attractive premium and a lack of advisory services to support capacity building, as well as limited guidance on the implementation of forest resource-based climate change adaptation actions and measures aimed at preventing and mitigating hazards (e.g., environmental fires, soil erosion, diseases, floods) (New EU Forest Strategy 2030; NFS, 2021). It is also worth mentioning the EU Biodiversity Strategy for 2030, which is a key component of the European Green Deal (EU Biodiversity Strategy for 2030). The strategy is aimed at protecting and restoring biodiversity in Europe, which includes an ambitious plan to plant at least 3 billion additional trees by 2030, in full respect of ecological principles. The aim of the plan is not only to increase forest cover in the EU but also to improve the quality of forest ecosystems, protect biodiversity, and increase forests' resilience to climate change. Trees will be planted in a sustainable manner, taking into account species diversity and local environmental conditions, which is expected to provide long-term ecological benefits. The implementation of this plan is one of the key elements in combating climate change and environmental degradation while supporting the goals of climate neutrality and the restoration of natural ecosystems in Europe. The urgent need to protect biodiversity and improve environmental quality in the face of climate change necessitates the development and implementation of a new programme for increasing the forest cover and the provision of coherent tools to support the conversion of afforested agricultural land into forests, as confirmed by Kaliszewski and Jabłoński (2022) in their study.

The new CAP (for the years 2023–2027) provides more flexibility in designing forest-related interventions according to national needs and specificities and reduces bureaucracy while linking and ensuring a synergistic approach between the European Green Deal, national forest policies and the EU's environmental and climate acquis. The Commission will seek to achieve a greater utilisation of funds allocated for rural development and available for the objectives of this strategy (New EU Forest Strategy 2030; NFS, 2021).

4.2 A comparative analysis of the expenditure on afforestation under the RDP in Poland and Lithuania

Based on data from EU reports, simulated trends in expenditure on afforestation are presented for Poland, Lithuania, and the EU level for the period of 2004–2024. Subsequent graphs will illustrate the expenditure *per capita* and per area and the correlations with other environmental and economic variables.

It can be seen from the graph below (Figure 2) that there has been a significant increase in expenditure on afforestation in each of the two countries and in the EU as a whole, with the largest increase in expenditure at the EU level.

Another study analysed the assumption that afforestation is related to the national income (GDP) for both countries, and it carried out a simulation of the income and afforestation data (Figure 3).

The graph shows a linear regression model illustrating the relationship between afforestation and the national income of Poland and Lithuania. The regression line for each country shows a trend indicating that an increase in the national income is linked to an increase in the afforestation area. The higher coefficient for Poland suggests that an increase in income has a greater impact on afforestation in Poland than in Lithuania. The negative value for Poland indicates a model that best fits the data at higher income values.

In the next stage of the research, analyses were carried out on the expenditure on afforestation in Poland and Lithuania in relation to the area of each country and their populations, with agricultural income also taken into account. The analysis examined the dependence of expenditure on afforestation on agricultural income, the population, and the area of the country. The following multiple linear regression model formula was adopted:

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon$$

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon$$

where:

YY - expenditure on afforestation *per capita*,X1X1 - agricultural income,X2X2 - population,X3X3 - country's area.

The model for Poland shows that the afforestation expenditure *per capita* is relatively stable and insensitive to changes in agricultural income. In contrast, the model for Lithuania suggests that agricultural income has a significant effect on afforestation expenditure *per capita*, with a more pronounced increase occurring as this income increases (Figure 4).

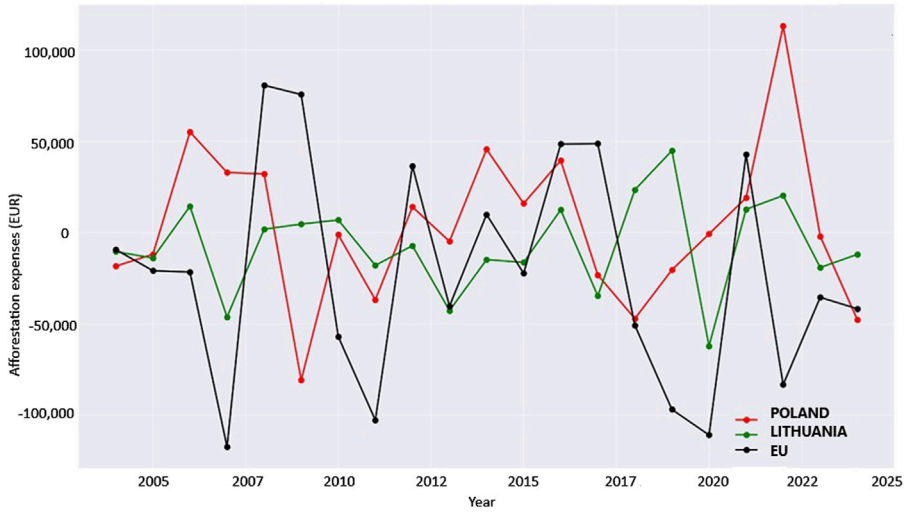

FIGURE 2
The trend in expenditure on afforestation in Poland and Lithuania compared to the EU.

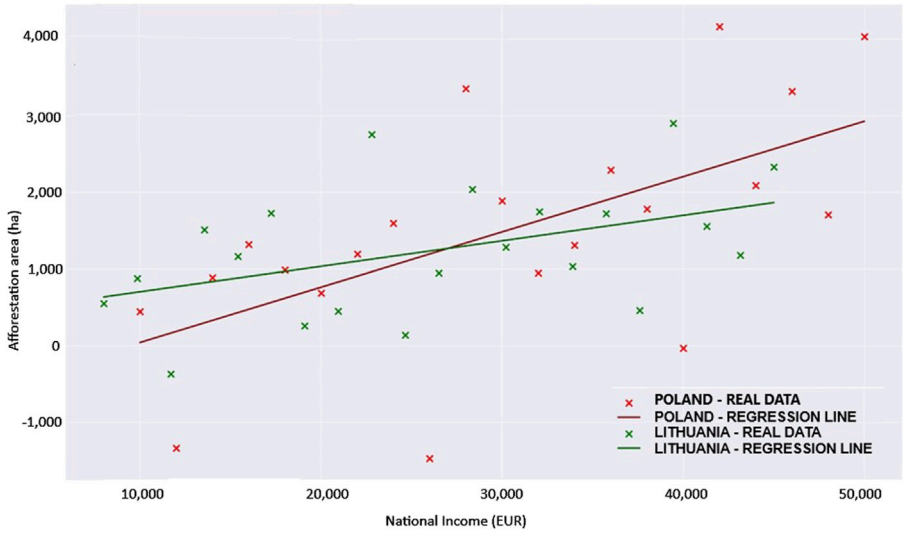

FIGURE 3
The relationships between afforestation and GDP in Poland and Lithuania.

In the final stage of the analyses, a Q-Q (quantile-quantile) plot was created as a graphical tool to assess whether the dataset follows a specific theoretical distribution, such as a normal distribution (Figure 5).

The graphs above (Figure 5) show a clear dependence of afforestation expenditure *per capita* on agricultural income. The regression lines for the two countries indicate a positive correlation, where higher agricultural income is linked to higher expenditure on afforestation.

In conclusion, the regression models showed a positive correlation between agricultural income and afforestation expenditure *per capita*, indicating the economic determinants of afforestation activities in the two countries.

An earlier study by Źróbek-Różańska et al. (2014), which assessed financial feasibility using the net present value (NPV) criterion commonly applied to assess the effectiveness of investments in the property market, confirms the low profitability of these activities. Based on afforestation statistics and considering the 5% discount rate in the Polish forestry market, that study showed the highest increase in cumulative net cash flows over the first 5 years, with a gradual decline in subsequent years. The longer the investment period, the lower the return is, even after excluding the discount rate. Investments of this type are difficult to terminate, as forests younger than 20 years are difficult to sell at a price that covers increasing outflows. Afforestation is a long-term investment that benefits future generations. These benefits need to be considered more from a social and environmental point of view. Private owners assess afforestation from the perspective of their own benefits, mainly

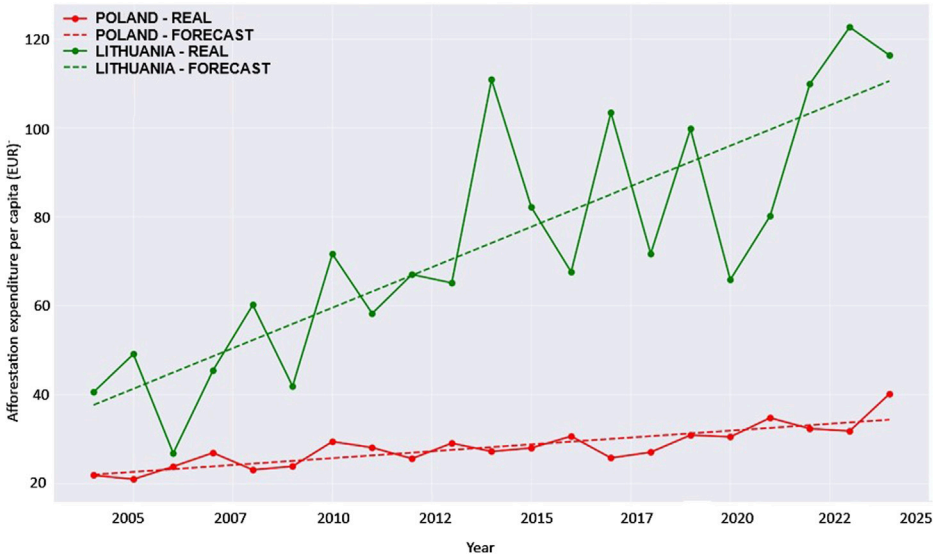

FIGURE 4
Expenditures on afforestation (forecast vs. reality).

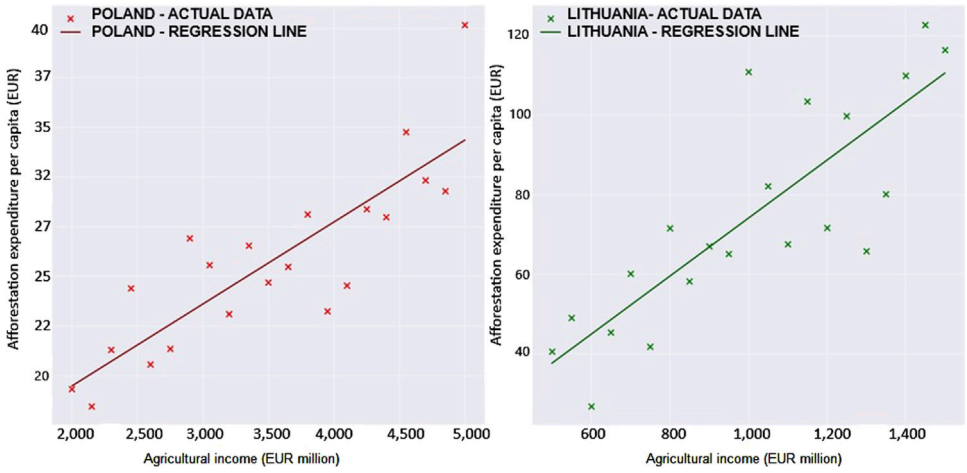

FIGURE 5
The relationships between afforestation expenditure and agricultural income.

cost-effectiveness. The merits of forestry investment in different countries depend not just on the local silvicultural forestry credentials but also on local costs of capital or discount rate, inflation, risk, and land acquisition costs (Kurowska and Kryszk, 2017; Chappell, 2019).

The identified determinants of forest cover growth in Poland and Lithuania are similar. These obstacles include the low supply of land for afforestation, the competitiveness of direct subsidies for agricultural production and the relatively low attractiveness of support for afforestation, limitation of the minimum area of an afforested plot, complicated procedures for applying for afforestation subsidies, insufficient education and promotion of afforestation among farmers, limitations of afforestation in Natura 2000 sites, and the exclusion of permanent grassland from afforestation. These factors are also confirmed by other studies conducted in Poland (Kurowska and Kryszk, 2017; Gołos et al., 2021; Kaliszewski and Jabłoński, 2022) and in Lithuania (Šepetienė et al., 2014; Veteikis and Piškinaitė, 2019; Mozgeris et al., 2021; Tiškutė-Memgaudienė and Tiškutė-Memgaudienė, 2021). In addition, Sulewski (2018) emphasises that in Poland, however, achieving positive effects in terms of increasing farm income is determined by the possibility of carrying out afforestation and maintenance works with the involvement of one's own labour force only.

As emphasised by Gołos et al. (2021), in addition to voluntary programmes based on owners' intrinsic motivation, which include afforestation under the RDP, programmes based on extrinsic motivation should be available, in line with the self-

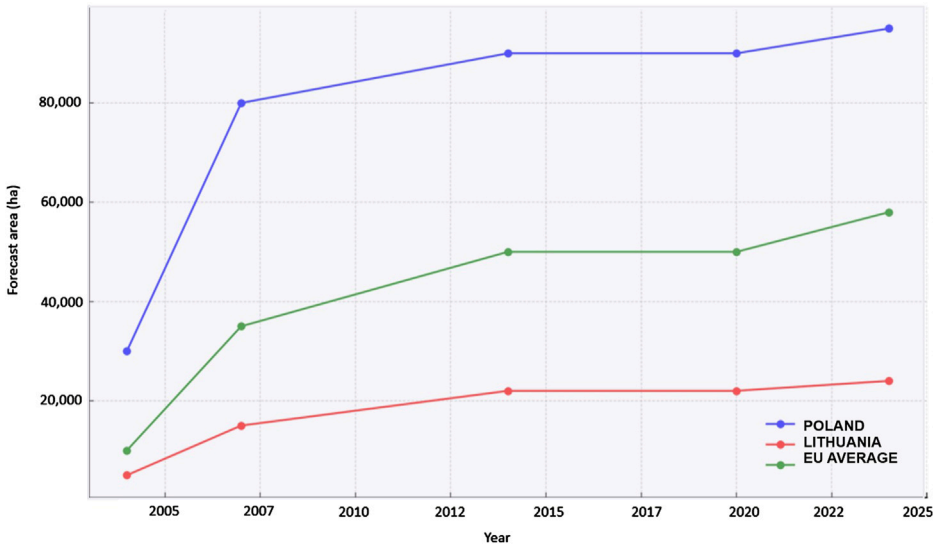

FIGURE 6
The balance of afforestation in Poland and Lithuania, compared to the European Union, in the years 2004–2020.

determination theory. This theory envisages, *inter alia*, a financial compensation scheme that could support the generation of public value (Mikša et al., 2020). Such a solution appears to be particularly desirable under conditions of the ineffectiveness of the existing policy and regulatory solutions when there is a growing concern that public benefits from private forest ownership will not be sufficiently ensured under the existing forest management schemes (Lindhjem and Mitani, 2012; Juutinen et al., 2021). Wysocka-Fijolek et al. (2020a) also emphasised that in order to increase interest in afforestation, there should be more support for young farmers who could be offered additional incentives to afforest land that is less useful to them as part of farm specialisation.

Poland saw the highest increase in the forested area in the years 2007–2013, which was due to intensive programmes supporting the afforestation of marginal agricultural land. Lithuania, while on a smaller scale, has also implemented afforestation measures, but their pace has slowed down since 2020. The average value for EU countries reflects the differences in afforestation policies of the individual Member States, taking into account their geographical and economic conditions. This is shown in the graph below (Figure 6).

The balance of afforestation in the years 2004–2024 indicates significant differences between Poland, Lithuania, and the European Union average. In terms of forested areas, Poland was the region's leader during the first two financial perspectives, but this activity has been slowing down since 2014. As for Lithuania, the afforestation rate was more stable but on a smaller scale. The EU average reflected the diversity of national policies, which gradually shifted priorities from simply increasing the forest area to improving the quality of forest ecosystems, in line with long-term climate and biodiversity protection goals.

Figure 6 shows the assessment of afforestation in Poland and Lithuania and the European Union average in the years 2004–2024, taking into account the milestones in the development of afforestation policies under the Rural Development Programme (RDP). Analysis of the budget periods reveals the varying afforestation rate, resulting from political, economic and geographical factors that affected the intensity of the measures being implemented.

The first financial perspective under RDP 2004–2006 was a crucial moment for the implementation of afforestation policy on a large scale, especially in Poland. The programme supported farmers in converting marginal agricultural land into forest land, which contributed to the afforestation of approx. 30,000 ha in Poland, and approx. 5,000 ha in Lithuania. The high afforestation rate during this period resulted from intensive efforts to promote an increase in forest cover in regions with a high proportion of low-quality land, which was in line with the EU environmental objectives, such as the protection of soils and biodiversity.

The second financial perspective, RDP 2007–2013, saw even more intensive afforestation measures. Poland afforested approx. 50,000 ha, which represented a significant increase compared to the previous period. This was linked to higher amounts of support and simplified administrative procedures, which encouraged more farmers to get involved in afforestation projects. Lithuania, while on a smaller scale, also increased its operations and afforested a further 10,000 ha. The EU average during this period also increased, thanks to extensive afforestation programmes in central and eastern European countries.

In the 2014–2020 perspective, the afforestation rate in Poland clearly declined, with only 10,000 ha afforested. This was due to a shift in EU policy priorities towards other environmental objectives, such as biodiversity conservation and organic farming. Many support programmes were focused on protecting the existing forests and converting them into multi-functional forests, which contributed to a reduction in new afforestation. During this period, Lithuania afforested a further 7,000 ha, and the EU average remained stable despite the fact that regional variations in the intensity of afforestation activities were observed.

For the period 2020–2024, a clear slowdown in afforestation has been observed in Poland and Lithuania, which is in line with general

trends in the EU, where afforestation policy focuses more on the quality of forests than on increasing the forest area. In Poland, approx. 5,000 ha were afforested, compared to approx. 2,000 ha afforested in Lithuania. In the European Union, in line with the Biodiversity Strategy for 2030, new goals have emerged, such as planting 3 billion trees by 2030, in full respect of ecological principles, which could bring new impetus to further afforestation activities in the coming years.

5 Conclusion

Afforestation of agricultural land is a key element of the two countries' environmental policies that contribute to improving biodiversity, carbon storage, and soil and water quality. Afforestation programmes in both countries have significantly contributed to an increase in forest cover, especially considering the reasonable use of space and afforestation of land that is least suitable for agricultural production.

Poland, thanks to its active policy, financial support, and the availability of agricultural land, has implemented extensive afforestation programmes. Lithuania has been afforesting land on a smaller scale due to limited land resources and different priorities. Interest in afforestation grants under the CAP and the average area of afforestation in the EU is due to the diversity of climatic, economic and political conditions in the individual Member States.

Poland and Lithuania have different approaches to afforestation. Although Lithuania has achieved a higher level of forest cover due to more decisive and consistent afforestation activities carried out even before joining the European Union, the study showed that, as time progressed, there was less interest in afforestation due to less favourable financial conditions. In the case of Poland, there were restrictions on qualifying land for afforestation. It is worth noting that the complex application procedures may discourage potential beneficiaries from joining the programme. This indicates the need to simplify processes and provide better information and advice to farmers, not only in the afforestation process but also in subsequent forest management. Currently, financial support is possible for up to 5 years after afforestation. Once the afforested land has been converted into a forest, the forest is supervised by the competent authority without additional financial support. Obviously, an afforestation premium is paid for up to 12 years in order to compensate for the permanent exclusion of agricultural land from agricultural production. This is a very short period of time, which is why this form of support for afforestation is hardly competitive with other programmes dedicated to agricultural land implemented under the RDP.

Since 2014, there has been a noticeable decrease in the rate of new afforestation, both in Poland and Lithuania, which is linked to a change in European Union policy priorities. The EU has begun to place greater emphasis on protecting the existing forests, enhancing their ecological quality, and tackling climate change, which has reduced the emphasis on converting new areas to forests.

There is also a need to adapt national afforestation strategies to changing climatic and economic conditions, taking into account long-term sustainability goals. Not only does afforestation contribute to environmental improvement, but it also offers new economic opportunities for rural areas through the creation of forestry- and tourism-related jobs.

In recent years, afforestation activities in the EU countries, including Poland and Lithuania, have increasingly become part of long-term environmental goals. The implementation of the Biodiversity Strategy for 2030, including the plan to plant 3 billion trees, shows that future measures will focus on ensuring a balance between the quantity and quality of forests, with full respect for ecological principles. Countries with higher levels of natural forest cover, e.g., the Scandinavian countries, focus on managing and protecting the existing forests, while Central and Eastern European countries, such as Poland and Lithuania, have reforested new areas to a greater extent, especially at the beginning of the period under analysis.

Efficient management and financing of afforestation activities are crucial to achieving climate, environmental and economic objectives both at the national level and in the context of the European Union's policies. European Union support for afforestation should continue to the extent that it ensures improved land use and prospects for long-term economic activity in rural areas.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/supplementary material.

Author contributions

HK: Conceptualization, Data curation, Formal Analysis, Methodology, Project administration, Resources, Software, Supervision, Visualization, Writing–original draft, Writing–review and editing. JV: Formal Analysis, Software, Supervision, Validation, Visualization, Writing–original draft, Writing–review and editing. DJ: Conceptualization, Data curation, Formal Analysis, Writing–original draft. AM: Formal Analysis, Supervision, Validation, Visualization, Writing–original draft. KK: Formal Analysis, Methodology, Supervision, Writing–review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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