SPATIAL ANALYSIS OF AFFORESTATION IN POLAND UNDER RURAL DEVELOPMENT PROGRAMME 2007-2013

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Abstract
The paper covers spatial analysis of the Measure "Afforestation of agricultural and other than agricultural lands" implemented in Poland within the framework of the Rural Development Programme 2007 – 2013 (RDP 2007 – 2013). Beneficiaries obtained payments for afforestation based on the commitments made during the programming perspective of 2004 – 2006 or they joined the programme during the perspective of 2007 – 2013. Data obtained from the Department for Direct Payments of the Ministry of Agriculture and Rural Development as of 31 December 2012 formed the base of the analysis. Payments made in the country to the beneficiaries considering their activity and absorption of funds within the framework of the measure are presented. Next, given the disbursements made in voivodships and counties of Poland, the activity of beneficiaries was indicated and average disbursements per beneficiary were determined. The analysis aims at investigating the consistency of the afforestation policy implemented in Poland as of 2004 and showing the role of afforestation projects implemented within the RDP framework. The aim of the article is to show spatial changes in the intensity and dynamics of agricultural land afforestation projects implemented within the framework of the RDP 2007 – 2013 considering natural conditions.
The afforestation rate and the ownership structure of the forestland in Poland is diverse. Afforestation allows and rationally manages agricultural land, which is of little use for agricultural production. The utilization of EU funds supporting afforestation of agricultural land in Poland is characterized by spatial variability.
Key words: Rural Development Programme, afforestation of land, afforestation rate, rural areas.

Introduction

Increasing the afforestation rate of the country is one of the major elements of forestry policy in Poland. In the past, as a consequence of socioeconomic processes, mainly increasing the area used for agricultural purposes, the afforestation rate of Poland decreased to 38% in 1820 and 20% in 1938. Consistent implementation of the goals of the afforestation policy accepted and implemented in Poland as of 1995 should assure increasing the afforestation rate of the country to 30% in 2020 and 33% by 2050 (KPZL, 2003).

Introduction of forest on non-forest land used for agriculture or representing temporary wasteland is referred to as afforestation (Płotkowski, 2008). The idea of land afforestation in our country appeared during the 19th c. The process was intensified after the World War II. Currently, around 30% of Polish forests grow on land that had been deforested and then used for agriculture or left waste (Szujecki, 2003). During the period of 1945 – 2000, the area of forests and lands related to forest economy increased from 6,470.000 ha to 9,059.000 ha, i.e. by 40.0%. During that period the afforestation rate of the country increased from 20.8% to 28.4%. The largest scope of afforestation projects was recorded during the 1960-s (even 60,000 ha a year were afforested) (Biczkowski and Głaz, 2012). Despite the earlier activities, the afforestation rate of Poland continues to be lower than the European average, which is 31.1%. The current afforestation rate of Poland is 29.3% (according to the Central Statistical Office data for 2012). Except Ukraine (afforestation rate at 17%), the other countries bordering Poland have higher afforestation rates (Byelorussia – 44%, Czech Republic – 34%, Lithuania – 36%, Germany – 32%, Slovakia – 40%). The rational afforestation rate of Poland, from the perspective of land use structure and environment development at the current civilisation development stage, should be 33 – 34% (KPZL, 2003).

Increasing the afforestation rate of the country and of its individual regions is consistent with international resolutions and treaties of which Poland is a signatory. It will serve accomplishment of the goals and environment status improvement formulated there (National Programme for Increasing the Afforestation Rate, 2003). Degradation of the natural environment is one of the major reasons for the necessity of implementing afforestation programmes both in Poland and other EU countries (Louwagie et al., 2011). As of 1 May 2004, Poland is a member of the European Union and the resulting necessity of implementing the principles of the Common Agricultural Policy (CAP) is tied to increasing the rank of areas with unfavourable natural conditions. The Common Agricultural Policy has been in operation since 1957, and it is a subject to continual reforms given the changing economic and international conditions (Upite and Pilvere, 2011). The EU CAP considers multidimensional correlations between the agriculture and the natural environment (Kołodziejczak and Rudnicki, 2012). Afforestation of agricultural lands is one of the measures serving accomplishment of that goal. It has been implemented within the framework of the Rural Development Programme 2004 – 2006 (RDP 2004 – 2006).

The measure had been continued within the framework of the RDP 2007 – 2013. Additionally, according to Schedule II, it had been continued as afforestation of non-agricultural land. Areas of fertility classes V, VI and VIz represent ca. 34% of the total area of agricultural land in Poland. Polish agriculture is characterised by an excessive use of land of low suitability for agriculture and the land exposed to erosion or other threats. Hence, afforestation of land is particularly important in case of Polish agriculture (Rudnicki, 2010; Biczkowski and Rudnicki, 2013). On the other hand, the involvement of Polish forestry in the development of marginal soils results, first of all, in the statutory performance of environment creating and public functions of forests. This applies mainly to the favourable influence of forests on the water balance of the country, limitation of erosion processes, preventing landscape changes into steppes, air, waters and soils cleaning of chemical substances, decreasing the greenhouse effect and improvement of living quality in urbanised areas (KPZL, 2003). As of 2005, an increased interest of farmers in agricultural land afforestation has been observed in Poland. This results from the possibility of afforestation financing within the frameworks of the EU Common Agricultural Policy. Moreover, farmers receive the afforestation bonus representing the compensation for income lost as a consequence of excluding land from agricultural use. The importance of environmental aspects in planning and implementation of afforestation works has been increasing. The public expectations related to taking into account the requirements of nature protection and landscape development as well as expanding biodiversity has also been increasing (Polna and Szczepański, 2010).

The aim of the study is to determine the preferences of beneficiaries implementing afforestation under the RDP. The analysis will identify barriers and factors affecting implemented afforestation of agricultural land in Poland. The question whether the Common Agricultural Policy assumptions and afforestation policy implemented within its framework represent an instrument efficient enough to attract farmers to agricultural land afforestation remains open. Farmers expect even more attractive funds for afforestation and only some of them are focused on temporary maximisation of profits in case of afforestation (Duesberg et al., 2013).

Materials and Methods

The paper aims at presenting the scale and spatial diversity in the use of funds for afforestation within the framework of the RDP during the years 2007 – 2013. Afforestation of agricultural and other than agricultural lands results in the permanent change of agricultural land (the least suitable for agricultural production) into forest. The national scale analysis was conducted. The regions (voivodships) and counties represented by 314 county offices of the Agency for Restructuring and Modernisation of Agriculture (ARMA) were assumed as the basic units. The analysis considered afforestation preferences resulted from the quality of soils, their spatial diversification and suitability of agricultural land for agricultural use. The current afforestation rates of the individual regions were also taken into account. The analysis of afforestation rates' change dynamics in counties during the years 2004 – 2012 was conducted too. In addition, the share of private forests was included in the total forest area. The appropriate measures were defined within the framework of the payments disbursed during the financial perspective of 2007 – 2013, which were as follow: the activity of beneficiaries in the individual counties and the amount of support received (in PLN).

The analysis was based on the data obtained from the Department for Direct Payments of the Ministry of Agriculture and Rural Development. The data covered the payments disbursed to beneficiaries that implemented the measure called Afforestation of agricultural and other than agricultural lands within the frameworks of the RDP 2007 – 2013 as of 31 December 2012. 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. The assumptions of the National Afforestation Rate Increasing Programme by 2050 were the baseline for the analyses conducted.

Results and Discussion

Conditions of afforestation in Poland

Exclusion from agricultural use of lands representing low suitability for agricultural use and afforestation of such lands influence the sustainable development of agriculture and rural areas positively, both directly and indirectly. The direct influence is represented by increasing the forest areas and afforestation ratio, hence, creating conditions for strengthening ecosystems and biodiversity in rural areas. Indirectly, afforestation creates opportunities for additional employment, and it also generates the income for the rural population (Polna, 2011).

The quality of Polish soils is among the lowest in Europe. The natural conditions of Poland from the perspective of agricultural production are 30 – 40% worse than in the Western European Countries. The production potential of the average hectare of our soils corresponds to the potential of the average 0.6 ha of arable land in the European Union. Hence, rational soil resources management is the most important issue considering appropriate functioning of ecosystems and protection of highly productive soils (Skłodowski and Bielska, 2009; Jarský and Pulkrab, 2013).

Table 1

Key conditions of afforestation in Poland

Item	Afforestation rate (%)		Share of private forests in total forest area (%)		Agricultural production space quality indicators (points)	Agricultural land according to the fertility class		
	2004	2012	2004	2012		V (%)	VI (%)	VIz (%)
POLAND	28.7	29.3	18.4	19.4	66.6	22.6	11.4	0.8
Dolnośląskie	29.1	29.6	2.3	2.9	74.9	16.5	5.2	0.2
Kujawsko-Pomorskie	23.1	23.4	10.5	11.4	71.0	15.7	8.9	1.0
Lubelskie	22.3	23.1	39.0	40.5	74.1	16.6	6.4	0.4
Lubuskie	48.7	49.1	1.2	1.5	62.3	27.7	15.1	0.5
Łódzkie	20.6	21.2	32.3	33.7	61.9	30.1	16.1	1.2
Małopolskie	28.4	28.6	43.5	43.7	69.3	21.8	8.6	0.7
Mazowieckie	22.1	22.9	42.2	43.8	59.9	28.4	16.6	1.3
Opolskie	26.3	26.5	4.3	4.7	81.4	15.6	6.1	0.0
Podkarpackie	36.5	37.8	14.7	16.9	70.4	20.1	7.4	0.6
Podlaskie	29.7	30.6	31.2	32.4	55.0	29.5	17.6	1.4
Pomorskie	35.8	36.3	10.5	11.2	62.2	21.3	13.3	1.2
Śląskie	31.7	31.8	20.0	20.1	64.2	25.9	10.0	1.1
Świętokrzyskie	27.5	28.0	26.6	28.2	69.3	22.0	13.6	1.4
Warmińsko-Mazurskie	29.9	30.9	4.9	7.1	66.0	18.8	6.8	0.2
Wielkopolskie	25.4	25.7	10.2	10.7	64.8	25.6	16.3	1.0
Zachodniopomorskie	34.7	35.4	1.3	2.1	67.5	20.5	6.7	0.6

During the years 1946 – 2001, the afforestation ratio (computed as the ratio of forest area to total area of the country) increased from 20.8% to 29.2%. Still, it is lower than the ultimate ratio set for Poland at the level of 33 – 34%. To accomplish the intended objective in 2020, it is necessary to include almost 485,000 ha of post-agricultural lands (unsuitable for agricultural production) and wastelands in afforestation projects during the years 2012 – 2020. During the years 1995 – 2011, 262,000 ha were afforested (Concise Statistical Yearbook of Poland, 2012).

In 2012, the afforestation rate of Poland was 29.3%. Uneven distribution of forests within the area of the country as well as significant crumbling and dispersion of forest complexes represented a significant problem. The current afforestation rates for the individual voivodships of Poland are presented in Table 1.

The highest afforestation rate in Poland is found in Lubuskie voivodships at 49.1%. Significant afforestation is also characteristic for Podkarpackie, Zachodniopomorskie, Pomorskie, Śląskie, Warmińsko-Mazurskie and Podlaskie voivodships. At the same time, those voivodships have high shares of low fertility class lands (class V, VI and VIz). In Poland, the ownership structure of forestland in the regions is very diverse. In 2012, it varied from 1.5% in Lubuskie to 43.8% in the Mazowieckie voivodship. In the years 2004 – 2012, it is during the implementation of afforestation under the RDP when a very large increase in the share of privately-owned forests was visible. The highest growth was recorded in Zachodniopomorskie voivodship by 61% and Warmia-Mazury 44%. Significant increase in the share of private ownership in the forest structure confirms the large impact of the RDP on increasing afforestation rate in the country.

Table 1 presents also the agricultural production space quality indicators reflecting suitability of agricultural land for agricultural production. The regional diversification of agricultural production space in Poland results from spatial differences in soil coverage, land morphology as well as precipitations and temperature. It is expressed in points, and it is the sum of the individual elements. The average rate for the country is 66 points. It is worth highlighting that the lowest agricultural production space quality indicator value is characteristic for Podlaskie voivodship at 55 points. In the region of Podlaskie the share of the poorest soils is the highest one.

The areas preferred for afforestation are situated mainly along the northern and eastern border of the country. During the years of 2004 – 2012, according to the general balance, the increase of the afforestation rate occurred in all the voivodships of the country (Table 1).

The highest increase was recorded in 69 counties distributed mainly along the northern and eastern border of the country. The smallest increase was recorded in the counties of Wielkopolskie and

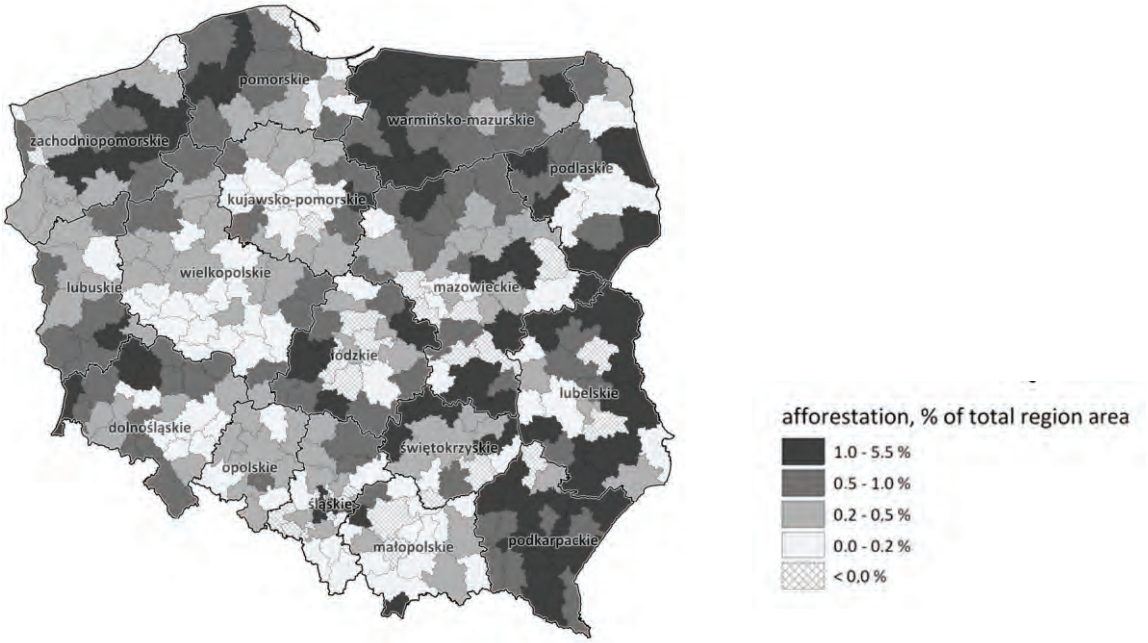

Figure 1. Dynamics of changes in afforestation rate in the counties of Poland during the years 2004 – 2012.

Małopolskie voivodships. It is worth highlighting that in 29 counties a slight decrease in afforestation ratio was recorded. That phenomenon is visible at most in Małopolskie, Łódzkie and southern part of Mazowieckie voivodship (Fig. 1). This is a consequence of allocating agricultural and forestland for uses other than agriculture and forestry.

Polish experiences in afforestation

Until accession to the European Union, a diversified system of afforestation works funding was in operation in Poland. The state-owned land had been afforested by the State Forests from the budget funds. The extent of afforestation works implemented depended significantly on the funds allocated each year for the purpose in the Budget Act. In addition to the budget subsidies, afforestation of private lands was supported from the funds of the Voivodship Funds for Environment Protection and Water Management and, to a marginal extent, from the State Forests funds in the form of free seedlings. During the years 2002 – 2004, the new system for agricultural land afforestation financing was applied based on the Act on allocation of agricultural land for afforestation. After Poland's accession to the EU, rural areas in our country became one of the major beneficiaries of the financial support system (Bułkowska and Chmurzyńska, 2011). Also, radical change in financing private land afforestation took place in Poland. Afforestation of agricultural lands is one of the measures included in the Rural Development Programme (Płotkowski, 2008; Polna, 2007).

Afforestation implemented within the framework of the RDP 2004 – 2006 was consistent with the National Programme for Increasing the Afforestation Rate (KPZL, 2003). It covered land that was not the property of the State Treasury. A farmer, a group of farmers (minimum 3 persons) or an agricultural production cooperative could be the beneficiary. Afforestation was carried on land that was qualified as agricultural land, including arable land, permanent green land, orchards and fruit plantations. Those land pieces should be under permanent agricultural use. They should also be classified mainly as fertility class V and VI and as land on slopes with inclination exceeding 12°. Afforestation of lands that lay idle or resting for longer than 5 years and wastelands were not covered. The share of class I-IV land should not exceed 15% of the area covered by afforestation. The farmer undertaking the activity was offered three forms of financial support. The first one was the support for afforestation represented by a single lump sum payment to cover the afforestation costs. The care bonus represented the additional form of support. It was a lump sum payment to cover the costs of maintaining the new forest plantation disbursed yearly for 5 years as of establishment of the plantation. The afforestation bonus was also a significant form of support. It aimed at balancing the income lost as a consequence of excluding land from agricultural production during 20 years as of establishment of the plantation. During the programming period of 2004 – 2006, no limitations for area afforested existed (RDP 2004 – 2006). The indicated criteria, however, were not respected fully.

Class I - IV land represented as much as 34% in the total area of afforested agricultural land (Drożdziel, 2007; Rudnicki, 2010). The RDP 2004 – 2006 budget for the measure: Afforestation of agricultural land was 2.71% of the total RDP budget (Bórawski, 2010).

Afforestation of agricultural lands within the framework of the RDP 2007 – 2013 was implemented according to two Schedules: Afforestation of agricultural lands (Schedule I) and Afforestation of lands other than agricultural (Schedule II – introduced as of 2008). Schedule II applies solely to forestry development of abandoned agricultural lands or the land left idle for which afforestation represents a reasonable method of development (e.g. protection against erosion). The use of natural succession within the above identified lands is assumed as a possible solution.

During the first stage of the RDP 2007 – 2013 implementation (until 2011), there was an area limit per one beneficiary (maximum 20 ha). Currently, the support for afforestation may be awarded to a single farmer for the area not exceeding 100 ha. Afforestation within the framework of the RDP 2007 – 2013 may not be carried out on land situated within NATURA 2000 areas, areas of sanctuaries of the nature, landscape parks, national parks of their protective areas unless the planned afforestation is in line with the goals of protection of those areas. One of the guidelines of the Regulation on detailed conditions and procedures for granting financial aid under the measure "Afforestation of agricultural land and afforestation of non-agricultural land" under the Rural Development Programme for 2007 – 2013 are determinants of planning (2001, No 48, item 390). Support for the afforestation of agricultural land is granted to the farmer of the land that has been designated for afforestation in local spatial development plan. In the absence of a plan for afforestation of agricultural land is not contrary to the findings of a study of conditions and directions of spatial management.

The principles of aid funds disbursement are identical as during the 2004 – 2006 period. However, the period of afforestation bonus was shortened to 15 years as of the forest plantation establishment. Farmers will obtain at least 25% of income from agricultural activity during the year immediately preceding lodging the application (RDP 2007 – 2013).

Afforestation projects implemented within the framework of the RDP 2007 – 2013

Within the framework of the measure of afforestation of agricultural land and afforestation of

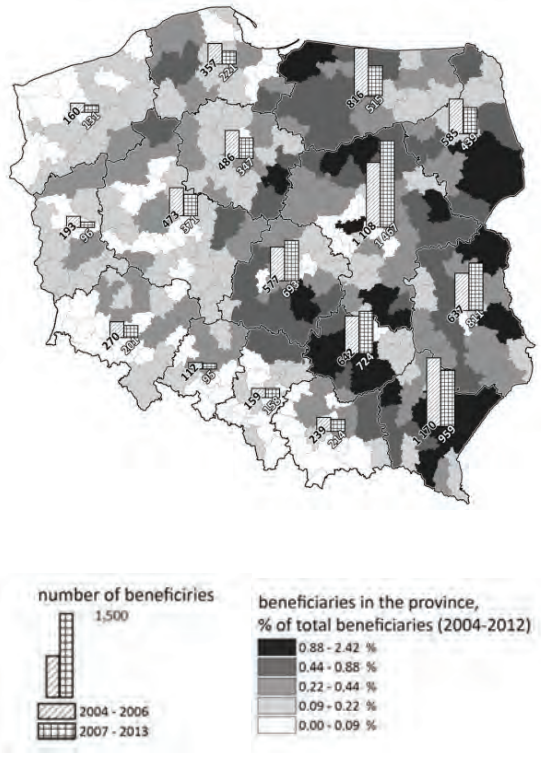

Figure 2. Activities of beneficiaries conducting afforestation and average disbursements per 1 application in the voivodship within the framework of the RDP 2007 – 2013 as of 31 December 2012.

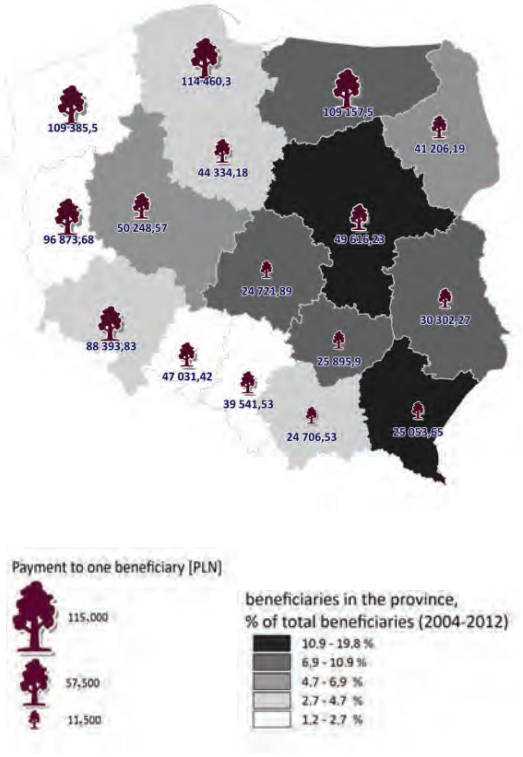

Figure 3. Activities of beneficiaries conducting afforestation in counties and number of applications (commitments contracted within the framework of the RDP 2004-2006 and RDP 2007 – 2013 as of 31 December 2012.

land other than agricultural under the RDP 2007 – 2013, the total of 15,500 commitments to beneficiaries were contracted in Poland. Until 31 December 2012, payments to the total amount of 650 million PLN had been disbursed.

Based on the disbursements as at the end of 2012 to the beneficiaries conducting afforestation on agricultural lands and lands other than agricultural (commitments contracted within the framework of the RDP 2004 – 2006 and RDP 2007 – 2013), it can be concluded that farmers from the central and eastern part of the country, mainly Mazowieckie and Podkarpackie voivodships showed the highest levels of activity (Fig. 2). However, the highest average disbursements per single application occurred in northern and western Poland (voivodships: Pomorskie, Zachodniopomorskie, Warmińsko-Mazurskie, Lubuskie and Dolnośląskie) (Fig. 2.). As concerns the spatial distribution of beneficiaries' activity given the number of applications lodged with county offices of the ARMA (counties), certain disproportions are clearly visible (Fig. 3). In Mazowieckie voivodship farmers from 6 counties only showed high interest in afforestation within the framework of the RDP. The City of Warsaw County where the largest number of applications for afforestation (or where afforestation was continued based on commitments contracted within the framework of the RDP 2004 – 2006) deserves a particular attention. This results from the fact that the farmers lodge applications with the county office of ARMA territorially competent for the registered address of the farm and not with the actual location of the agricultural land.

Figure 4 covers funds for afforestation within the framework of the RDP 2007 – 2013 considering the programming period during which the commitment to the beneficiary was made (2004 – 2006 or 2007 – 2012). Afforestation projects implemented during the first financial perspective (2004 – 2006) were passed for financing from the RDP 2007 – 2013 budget (care bonus and afforestation bonus). The afforestation rate increase was defined for the years 2004 – 2012, and it covers the afforestation projects implemented by both the private sector and the State Treasury.

Based on Fig. 4, it can be concluded that the activity of agricultural farms measured by the number of applications lodged is diversified. It decreases from the south-east towards the west of the country. Mazowieckie voivodship generated the most favourable results. The highest number of applications was lodged there, and a significant amount of disbursements (21% of the budget) was made there. A significant increase in the afforestation rate was also recorded in the region. Warmińsko-Mazurskie voivodship was the second in the volume of disbursements for afforestation. It is characterised by better soils (particularly in the northern part) and a high percentage of large farms (exceeding 20 ha). Hence, the average disbursement per a single

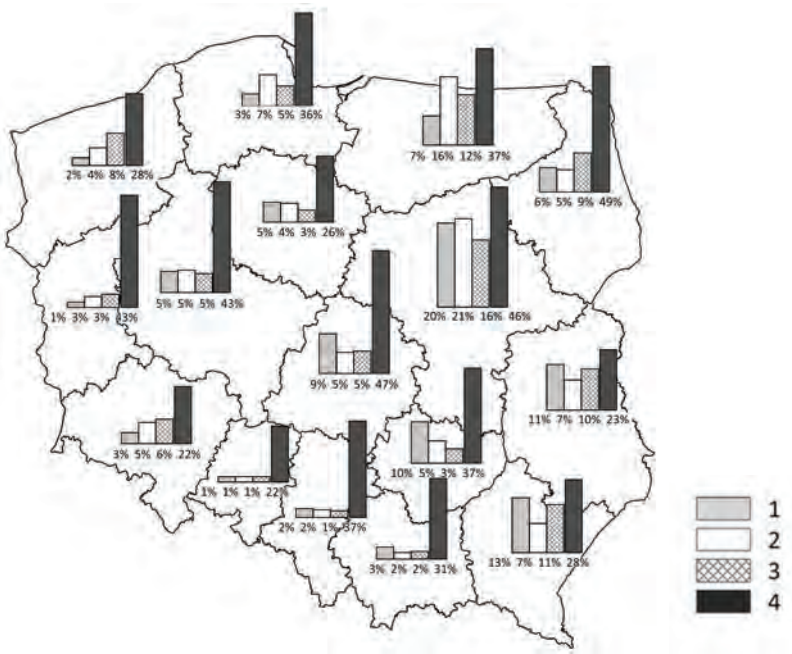

Figure 4. Afforestation financed within the framework of the RDP 2007 – 2013:
1- number of applications (%), 2 – payments disbursed (%), 3 – afforestation rate increase (%),
4 – area of class V, VI and VIz soils (%).

application is among the highest disbursements nationwide (109,500 PLN).

Conclusions

There are many voivodships in the country with extensive recommendations for afforestation. Based on the research, we can draw the following conclusions:

1. Significant increase in the share of private ownership in forest structure confirms the large impact of the RDP on increasing afforestation rate in the country.
2. The farmers are unwilling to conduct afforestation even on poor soils because afforestation means permanent exclusion of land from agricultural production. Podlaskie voivodship in north-east Poland is an example. It is characterised by the worst suitability of land for the agricultural production, but it is seen as a typically agricultural region (dairy production).
3. Planning conditions also represent a significant constraint to afforestation of agricultural land. Afforestation can be carried out on condition that it is not contrary to the findings of the study of conditions and directions of spatial development of the commune, or if the local spatial development plan in which areas for afforestation are considered, has been enacted.
4. During the implementation of the RDP 2007 – 2012, during the period of 2007 – 2013, the total of 650 million PLN was disbursed to Polish farmers. The RDP funds absorption level is also confirmed by the average payment per 1 application. The national average disbursement was at the level of 42,000 PLN, but the diversification of disbursements was large. The lowest average disbursements were recorded in the southern voivodships (ca. 25,000 PLN) but the highest in the northern part of the country (under 100 thousand PLN).
5. In Poland, since 2004, the value of agricultural land has significantly increased. This is the reason why farmers are reluctant to afforestation projects. Afforestation premium does not compensate the farmer enough to abandon the crop field. In this situation, farmers expect much higher rates in the RDP 2014 – 2020.
6. Given the high percentage of poor soils in the structure of agricultural land and availability of funding for afforestation to Polish farmers within the framework of the European Union funds we should hope that the private sector can play a significant role in increasing the afforestation ratio of the country.
7. Rational implementation of new afforestation projects may also contribute to better organisation of the agricultural-forest border with the benefit to landscape value, functioning of forests and agriculture.
8. The determination factor in the afforestation of agricultural land is the availability on the market of agricultural property and its market value. Natural conditions and soil quality is of secondary importance. As confirmed by studies from the point of view of each beneficiary, the most important is the cost-effectiveness of afforestation.

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