PL5 (Chlapowski Landscape Park, Poland): The importance of shelterbelts and CAP greening for landscape and performance of farms in Chlapowski Landscape Park

Introduction

The rationale for this study is the recent reform of the multi-objective Common Agricultural Policy (CAP). The new CAP aims to increase the market orientation of EU agriculture and to provide income support for farmers while introducing environmental protection requirements and taking action to accelerate the development of rural areas across the EU. The current reform of the CAP started in 2010. In June 2013, a political agreement on the reform of the CAP was reached and finally in December 2013 the Council of EU Agriculture Ministers formally adopted the regulations for the reformed CAP (EC 2013).

Basic objectives of the CAP, presented in those documents are formulated as follows: viable food production, sustainable management of natural resources and climate action balanced territorial development. In order to achieve these long-term objectives of the CAP, the existing policy instruments have to be adjusted. Therefore, the reform of the CAP focuses mainly on operational objectives by providing effective policy measures designed to improve the competitiveness of the agricultural sector and its sustainability in the long term. Giving a high priority to environmental objectives of the reform introduced the various instruments, aiming to provide environmental benefits – this part of the reform is called "greening" of the CAP.

The idea of "greening" the CAP has arisen numerous controversies, mostly due to ambiguously defined objectives whose effects were difficult to estimate. Introduction of "greening" may affect the size and structure of crop production, and thus may cause changes in the level of farm income, but also an impact on landscape features can be foreseen. This is due to the following basic requirements of "greening":

Crop Diversification, which sets up a minimum number and share of crops in arable land area at the farm. On farms with more than 30 hectares of arable land, at least three different crops have to be grown - the main crop should not exceed 75% of arable land and two main crops together must not exceed 95% arable land. On farms covering between 10 and 30 hectares of arable land there have to be at least two different crops grown and the main crop shall not exceed 75% share in the arable land area. Farms below 10 ha of arable land are excluded from the obligation of crop diversification.

Maintenance of existing areas of permanent grassland, with the right to reduce the area by not more than 5% compared to the base year;

Maintenance of Ecological Focus Areas (EFA), which includes ecological land such as land left fallow, terraces, landscape features, buffer strips and afforested areas. The minimum area is set as 5% of arable land, but starting from 2018 it may be increased to 7%. Farms below 15 ha are excluded from this requirement. The regulation provides also a "greening equivalency" system to acknowledge

certain farming practices beneficial for the environment and the climate which can be considered equivalent to the EFA.

In order to avoid penalizing those farmers that already farm in an environmentally-friendly manner, there are a number of farms excluded from the required fulfilment of the "greening" requirements: organic holdings, farms with large areas of permanent grasslands or other herbaceous forage and fallow land, and farms in the very North of Europe.

Objective

The main objective of this report is to analyse and describe the potential impact of new CAP instruments on the landscape, its management, and performance of farms located in the Chlapowski Landscape Park. The focus of the study is on shelterbelts, which are a specific feature in the Chlapowski Landscape Park and an important element of the local landscape.

Methodology

The key objective of the study is to assess the impact of natural landscape elements (shelterbelts) on performance of farms in terms of cropping structure, volume of production and farm incomes. An additional objective is to examine potential impact of the recent reform of the CAP on both, the landscape, biodiversity and agricultural production. Farm optimization model was used as a tool for the analysis. The model was run for 22 farms of different size and production orientation that might be considered as typical for the area of the Chlapowski Landscape Park. Data was collected in autumn of 2013. Majority (21) of farms were randomly selected in the Park area. The biggest farm was intentionally selected as an example of commercial, intensive, industrial type of agricultural activity performed in the area of high natural value.

Regarding policy measures that may influence landscape structure in the case study area, the following instruments have been taken into account in the scenarios:

- basic greening requirements as proposed in the final EC proposal;
- replacing Ecological Focus Area (EFA) with equivalents, which may bring the same or a higher level of benefits for the environment and climate change. According to the draft regulation of the European Commission each Member State will draw up a list of activities, which will be considered to be equivalent to practices related to "greening". To convert individual equivalent practices to the EFA area, appropriate weighing coefficients will be used, taking into account the importance of certain categories of land for the environment. Equivalent practices considered in the farm model will be shelterbelts, nitrogen binding crops (legumes), catch crops and fallow land.

6 scenarios were considered for modelling

- BASE Scenario [Base_2013] constructed only for calibration of the model based on data acquired through the farm survey.

- BASELINE_2020 scenario [Baseline 2020]This scenario assumes continuation of the current CAP without any change to the existing mechanisms of the CAP. Baseline scenario will provide a benchmark for other scenarios of the reformed CAP.
- BASELINE_2020 NO TREES scenario [Baseline NT 2020]: Scenario assuming continuation of the current CAP and removal of shelterbelts. In this scenario, the area of land under shelterbelts will be added to the area of arable land. It is anticipated that due to changes in natural conditions (no protection against winds) some of the crops like sugar beets, rapeseed and potatoes would provide lower yields and their cultivation becomes more risky. It was assumed that average expected yields of sugar beets, rapeseed and potatoes would be respectively 50%, 30% and 20% lower if there were no shelterbelts in the area.
- GREEN_2020 scenario [Green 2020]: In this scenario, the area of shelterbelts is maintained and "greening" requirements (diversification, EFA, permanent grassland) are imposed on the model. Meeting the requirements is a condition for receiving the full rate of direct payments (estimated for Poland at 219.05 euro/ha), in which 30% of "green payments" is included. It is also assumed that existing agri-environmental payments per average farm, which will be the subject of modelling, will be reduced by 50% due to the inclusion of “greening” component and the likely reduction in financing environmental measures of the second pillar.
- GREEN_2020 NO EQUIVALENTS scenario [Green NE 2020]: This scenario assumes preservation all shelterbelts within The Park and maintaining all CAP reform requirements except Ecological Focus Area equivalents. In this scenario shelterbelts will not be recognised as an equivalent to the EFA.
- GREEN_2020 NO TREES scenario [Green NT 2020]: Scenario assuming maintaining all CAP reform requirements but removing shelterbelts with all consequences described in scenario Baseline_2020 NO TREES.

Farm optimization model

To determine the potential effects of CAP changes, the farm optimization model expanded with non-linear cost function from the method of Positive Mathematical Programming (Howitt, 1995) was used. The main assumption on which the model is based, is rational, from an economic point of view, behaviour of farmers, who want to maximize their profits. The objective function assumes maximization of the farm income. General form of the objective function is shown in the following equation:

$$\underset{x_i \geq 0}{DR} = \mathbf{p}^T(\mathbf{x} \bullet \mathbf{y}) + \mathbf{s}^T\mathbf{x} + fs - fc - \mathbf{d}^{\mathbf{T}}\mathbf{x} - \mathbf{x}^{\mathbf{T}}\mathbf{Q}\mathbf{x}$$

provided that Ax ≤ B, where: DR - agricultural income (numerical value of objective function); p - vector of prices (n x 1); y - vector of yields and productivity (nx1); x - non-negative vector of optimum levels of production (n x 1); x•y – Hanamard product; s - vector of payments for production activities (n x 1), c - vector of input prices (z x 1); T-matrix for consumption expenditure for individual activities (z x n); fc- value or fixed costs; fs- value operational subsidies relatively independent of the level of production; A - resource utilization coefficient matrix (m x n); B - vector of available resources (m x 1), d’x-x’Qx – nonlinear element of the objective function determined during model calibration.

To capture appropriate market effects, which are exogenous factors in farm model, the CAPRI model (Britz and Witzke 2012) was used to calculate changes of prices and yields under scenarios considered. CAPRI is a partial equilibrium (PE) model for the agricultural sector. Differently than in other PE models, CAPRI estimates supply in a way similar to farm models, however at a higher level of aggregation (NUTS 2). In this study, CAPRI results have been used to asses changes of yields and prices in considered scenarios.

Results

Results of all tested scenarios show the importance of shelterbelts and likely reaction of surveyed farmers to the changes in agricultural policy. The results have been presented for clusters of farms of similar area of arable land (below 15 ha, 15-30 ha, 30-100 ha, more than 100 ha). Additionally, the scenarios testing introduction of the "greening" of the new CAP two other indices has been used: Shannon index (Shannon 1948), to measure impact on biodiversity and minimal share of the Ecological Focus Area (EFA) as required in the new CAP regulations.

Looking at the generalized impact of considered scenarios within the park area (Figure 1) it should be pointed out that, although all farms at the initial state fulfilled crop diversity criteria, introduction of all CAP greening requirements (Green scenarios) resulted in an increase of crop diversity measured by the Shannon index. The main reason for that is assigning of some of the arable land to areas recognized as EFA (fallow land, protein crops, green cover, and herbaceous forage crops). This increase is the highest in the "Green NE" scenario due to the need of designating the greatest area to the EFA and preserving share of the High Profit Cash Crops (HPCC)[1], which both lead to the decrease of the share of cereals in the cropping structure.

The impacts of the analysed scenarios on the organization of crop production at the farm level depend strongly on farm size. Model results for the smallest farm cluster (below 15 ha, which are excluded from CAP greening requirements) show that cropping structure is not vulnerable to conditions assumed in the scenarios considered. Small differences could be observed in the case of scenarios in which removal of shelterbelts (No Tress - NT scenarios) is assumed. Farms belonging to the second cluster (15-30 ha) have a specific initial cropping structure characterized by a high share of cereals. Removal of shelterbelts reduces the initial HPCC share from 6.8 % to 4.7% in "No Trees" scenarios. Requirements of the CAP greening policy have visible impacts on the size of the Ecological Focus Area in these farms. In case shelterbelts are treated as an equivalent to the EFA, new requirements are fulfilled relatively easily by increasing the share of EFA from 0.7% in the baseline scenario to 1.9% in the Green scenario. In the Green NE and Green NT scenarios, the required 5% share of the EFA is created at the expense of cereals.

In the cluster of the largest farms (30-100 ha) the share of highly profitable cash crops is increasing at the expense of cereals. The initial share of EFA is relatively high, which is due to cattle production which is held in 7 out of 8 surveyed farms. Because of a relatively high share of the EFA areas and high crop diversity due to the significant share of HPCC, the greening of the CAP has a limited impact on the cropping structure as all requirements are fulfilled in the Baseline scenario. Removing

[1] Sugar beets, potatoes and oil-seed rape considered in Polish conditions as most profitable

shelterbelts leads to the replacement of one fifth of the area of HPCC by cereals other than wheat and fodder crops. This, although the crop diversity in this group of farms is relatively high, leads to a decrease of the Shannon index in NT scenarios.

Farms from the largest farm size cluster have the most diversified cropping structure. Profitable cash crops dominate the cropping structure and farms belonging to this cluster have the highest average value of the Shannon index. Cattle breeding activities induce existence the EFA even in Baseline scenario. In the “Green” scenario, due to the use of shelterbelts as an equivalent, the requirements are met at the level of 4.5% EFA in cropping structure, while in “Green NE” and Green NT” at least 5% of arable land has to be assigned to EFA.

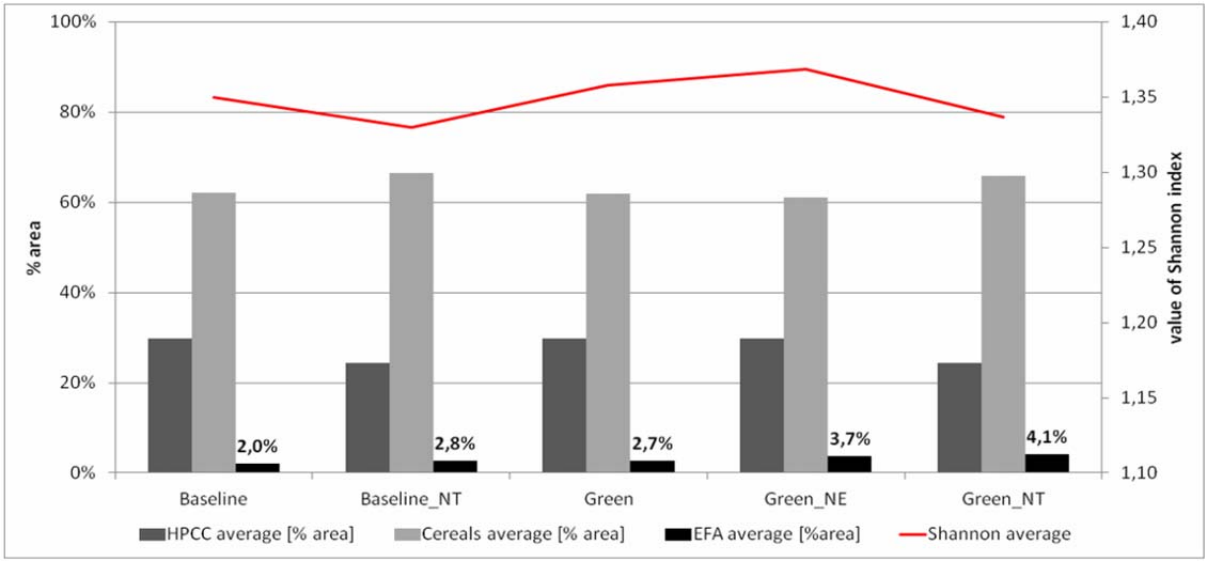

Figure 1. Changes of cropping structure in farms in Chlapowski Landscape Park area under considered scenarios. Source: Own calculations

It should be also noticed that, recognizing landscape elements (like shelterbelts or single trees, ponds and forests edges) as the EFA equivalents in the "Green" scenario allows for fulfilling the CAP requirements by assigning only 2,7% of agricultural land to the EFA. In the "Green NE" scenario the required minimum share of the EFA is at the level of nearly 3,7% on average in the Chlapowski Landscape Park area. Fulfilling of the CAP criteria whilst keeping the average EFA share below the 5% threshold is explainable as there is a large number of small farms (below 15 ha) which are released from this obligation.

Results of modelling show that the conditions assumed in the scenarios considered have also some influence on animal production. Although the greening of the CAP does not consist of any animal related measures, slight changes in herd sizes could be noticed. In farms of 30-100 ha, some milking cows are replaced by pigs. To a smaller extent similar changes could be noticed in the farm cluster 15-30 ha. On average, however, the greening of the CAP has a negligible impact on animal production.

Different policy scenarios have an impact on economic performance of farms (Figure 2), although it largely depends on the farm size. In general, farm incomes in both "Green" scenarios that maintain shelterbelts (Green, Green NE) are the highest in all clusters of farms of a different size, gaining

relatively much in comparison to the Baseline scenario. In the "Green" scenarios, assumed price increase compensates adjustment costs resulting from implementing the new CAP regulations. Additional costs are relatively low as many of farms fulfil the CAP greening criteria nowadays.

The biggest winners are the largest farms in the Park, which gain up to 3.7% of income of the Baseline scenario. Taking into consideration changes in all farm size clusters, on average, introduction of the new, “green” CAP should lead to a small increase of profitability of farming in Chlapowski Landscape Park, mostly driven by expected increase of prices of agricultural commodities.

Looking from another perspective, model results clearly indicate that preserving shelterbelts is an economically justified option despite farm size and policy scenario. Assumed drop in yields of crops which are under threat of wind erosion reduces significantly profitability of farming in the Park area. Even if the cropping area is increased by the area released due to removal of shelterbelts, it does not compensate losses in the revenues of HPCCs. The decrease of farm income due to the removal of shelterbelts is correlated with the share of HPCC in arable land.

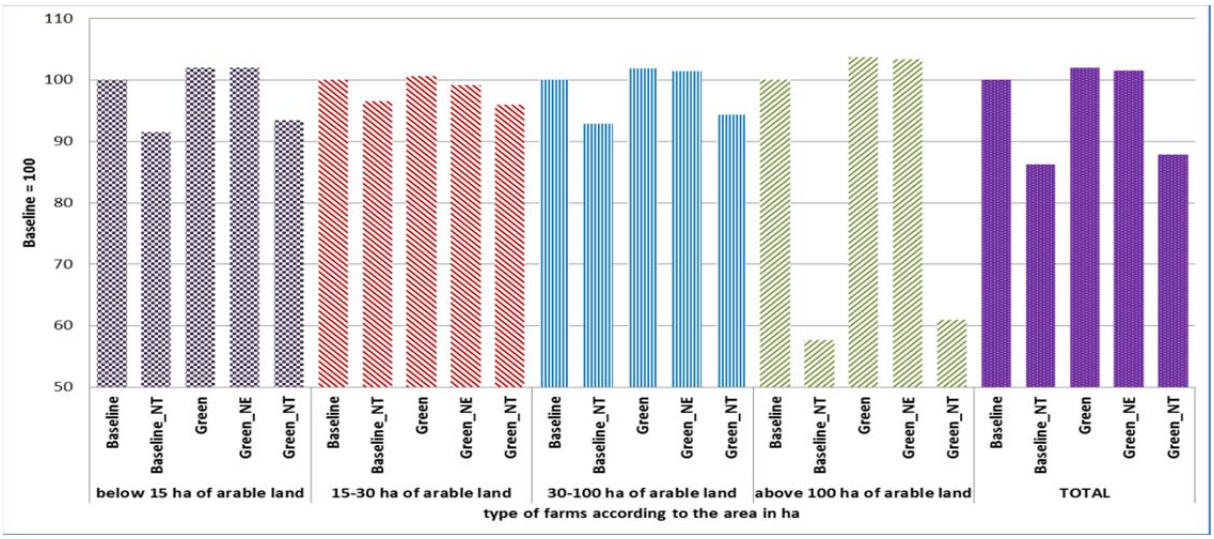

Figure 2. Changes in Net Farm Income per hectare (Baseline = 100 %). Source: Own calculations.

Removing shelterbelts has the most noticeable impact on farm incomes in the largest holdings (over 100 ha). Without shelterbelts, the average net farm income decreases by over 40% in this group of farms. It is obvious, as those farms have the highest gains in crops from protection against the wind.

On the other hand, the lowest loses in case of removing of shelterbelts are observed in results of middle size farms (15-30 hectares). Due to the high share of cereals those farms are not benefiting from the existence of shelterbelts. This explains why in the interviews, small farmers (usually having less HPCC) were not keen to establish new shelterbelts on their land, even with public support, while farmers from the largest farms invested their own resources to expand the system of shelterbelts on their agricultural land.

On average, incomes of farms located in Chlapowski Landscape Park could be about 15% lower in case of shelterbelts removal. It should be emphasized, however, that the distribution of costs and profits from protection offered by shelterbelts is not even. Thus it might be pointed out that some

measures that cover to some extent costs of establishing and maintaining shelterbelts for the smallest farmers could be proposed.

Differences in the level of farm incomes between scenarios correspond with the level of the public support leading to changes in dependency of farm incomes on the EU payments. On average the share of direct payments in Net Farm Income in the Park area does not exceed 15% in scenarios assuming preserving shelterbelts. The share of direct payments in farm incomes is noticeably greater in scenarios that assume removal of shelterbelts. Arable land unprotected against unfavourable climatic conditions e.g. wind erosion, is less suitable for growing the most profitable crops. This leads to a decline in crop revenues, which consequently increases direct payments importance as a support of the farm income. The share of direct payments in farm income reaches nearly 18% in scenarios assuming removal of trees. It should be noticed that the share of subsidies in farm income is varying depending on farm size.

The losses in farm income in the "NT" scenarios, assuming removal of shelterbelts, are the highest in the largest farms. Because the level of EU support is similar in all scenarios an income reduction among the largest farms due to removal of trees results in an increase of share of subsidies in the by up to 30%.

Lesson learned & Policy Recommendations

Shelterbelts which are unique and distinctive elements of the landscape in the Chlapowski Landscape Park play an essential role in shaping natural conditions for farming in the Park area. Providing protection against wind erosion they allow growing more profitable crops like sugar beets, oil-seed rape and potatoes. Without shelterbelts cropping structure in the case study area would be different, with domination of oats, rye, and triticale with addition of grassland. Thus, it can be stated that maintaining shelterbelts creates specific landscape features and increases competitiveness of the region, having an impact on productivity and profitability of the agricultural sector.

The introduction of greening has a low impact on both farm incomes and production in the Park area, assuming preservation of shelterbelts. It should be noticed that recognition of landscape elements as an EFA equivalent leads to an increase of net farm income. Thus, it could be stated that the importance of shelterbelts would be greater if they were treated as an equivalent of EFA.

CAP scenarios that assume removal of shelterbelts show a strong negative influence on the level of Net Farm Incomes. Even a relatively small decrease of the share of HPCC in the cropping structure (due to the reduction of wind-protection) could have a strong negative influence on the economic performance of farms in the case study area.

The impacts of both CAP greening and removal of shelterbelts is different among farms. Even though all farms are very vulnerable to removal of shelterbelts the strongest economic justification of using trees as wind protection could be observed in largest farms. The same group of large farms is gaining most from the introduction of the new CAP, while gains expected due to the new “green” policy in small farms are not so significant, especially if analysed in the nominal terms.

Both greening of the CAP and shelterbelts has a negligible impact on animal production. Even though in a few cases strong decrease of sugar beets area could lead to compromise initial fodder balance it has hardly any effect neither on farms organization nor on its economic performance.

Responsible partner/person

Agata Malak-Rawlikowska, Edward Majewski
Warsaw University of Life Sciences – SGGW
ul. Nowoursynowska 166, 02-787 Warsaw Poland
agata_malak_rawlikowska@sggw.pl