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Quantification of Changes in the State of the CR Agricultural Land Fund from 2001-2013

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Anotace

Cena zemědělské půdy v Česku je výrazně nižší než v ostatních státech EU, ale její úrodnost a způsob obdělávání se od okolních zemí neliší. Zemědělská půda v ČR ubývá, cca 12 ha/den (MZe, 2012). Orná půda v ČR ztrácí svoji produkční hodnotu z hlediska zajištění potravinové bezpečnosti, převedením orné půdy do víceletých kultur, trvalých travních porostů, výsadbou rychle rostoucích dřevin, zalesněním aj. Hlavním cílem výzkumu bylo analyzovat vývoj stavu zemědělské půdy v ČR za období let 2001-2013. Výsledek: Negativním jevem je to, že k vyšším úbytkům zemědělské půdy dochází i na kvalitnějších půdách (hodnocení dle průměrné úřední ceny na bázi BPEJ). Úbytek kvalitativně lepší zemědělské půdy ve vybraných krajích (50,1% ZPFČR), je v porovnání s celostátním úbytkem menší. Vývoj úbytku orné půdy ve třech kvalitativně nejhorších krajích ČR ve sledovaném období je sice výrazně nižší než průměr ČR, ale hospodaření na méně kvalitních půdách není ekonomicky výhodné. Z hlubšího hodnocení dvaceti jedna okresů ČR (30,15% ZPF ČR) vyplývá, že pozitivním vývojem relativních změn stavu zemědělské půdy vůči rozloze okresu, prochází jen tři okresy, 13 okresů má relativní úbytky nižší než relativní úbytek ČR. Dílčím cílem bylo zjistit, zda existuje závislost mezi velikostí obce (dle počtu obyvatel) a změnou ve výměře zemědělské půdy, především z hlediska úbytků zemědělské půdy. Na vzorku 56 obcí nebyla prokázána silná těsnost závislosti mezi sledovanými veličinami.

Klíčová slova

Úbytek zemědělské půdy, orná půda, trvalé travní porosty, tržní cena zemědělské půdy, úřední cena půdy, dotace, pacht.

Abstract

The price of agricultural land in the Czech Republic is significantly lower than in other EU states; however, its fertility and method of cultivation does not differ from surrounding countries. Agricultural land area in the CR is decreasing about 12 ha/day (MoA, 2012). Arable land in the CR is losing its production value, from a food security standpoint, through the conversion of arable land into perennial cultures or permanent grassland, outplanting of fast-growing woody plants, afforestation, etc. The main aim of the research was to analyse developments in the state of agricultural land in the CR in the period 2001-2013. Result: One negative phenomenon is the fact that a larger decrease in agricultural land is happening even on higher-quality lands (an evaluation according to the average official price based on CSEU – Classified Soil-Ecological Units). The decrease in qualitatively better agricultural land in selected regions (50.1 % of the ALF CR – Agricultural Land Fund of the Czech Republic) is lower in comparison with the nationwide decrease. The development of the decrease in arable land in the three qualitatively worst regions of the CR, within the monitored period, is significantly worse than the CR average; however, farming on lower-quality lands is not economically advantageous. A deeper evaluation of twenty-one districts in the CR (30.15 % of the ALF CR) shows that only three districts are experiencing a positive development in the relative changes in the state of agricultural land in relation to the area of the district. 13 districts have relative decreases lower than the relative decrease in the CR. A partial aim was to find out whether there is any dependency between the size of a municipality (according to the number of inhabitants) and a change in the acreage of agricultural land, especially from the viewpoint of decreases in agricultural land. From a sample of 56 municipalities, no strong dependence between the monitored quantities was proven.

Key words

The loss of agricultural land, arable land, permanent grass growths, market price of agricultural land, official land price, subsidies, rent.

Introduction

The main aim is to analyze the development of changes in the use of agricultural land in the CR in the period 2001-2013.

The main aim will be fulfilled on the basis of partial aims:

- Quantification of use of the agricultural land fund, i.e. changes in the state of arable land, and of the growth in permanent grassland on primarily high-quality soil in the CR in the time period 2001-2013, according to an available database of the Czech Office for Surveying, Mapping and Cadastre (COSMC).
- A statistical analysis evaluating the dependency of a selected factor (percentage change in the proportion of agricultural to municipal land, sized in ha) on the size (number of inhabitants) of a municipality or town, in a chosen collection of qualitatively better soils.

For what reasons should agricultural enterprises purchase agricultural land? Economists agree that there is a high probability that the acreage of small farms throughout Europe will decrease more and more, and that these farms will then terminate their activities (Kristensen et al., 2004). Better monitoring and understanding of the factors which lead farmers to leave agricultural land is important, and provides a valuable guide for land-use policy (Prishchepov, 2013). Čechura (2012) deals with an analysis of technical efficiency and the total productivity of production factors in agriculture in the Czech Republic. Factors connected with institutional and economic changes, as well as the growth in agricultural subsidies, are among the most important factors which determine technical efficiency and the productivity of production factors.

If the direct payments are effectively used in the production of agricultural crops, they have a positive impact on both the tenants of agricultural land and the landowners, who can benefit in return from the support provided to tenants (Ryan et al., 2001, Patton et al., 2008). Higher rents will eventually increase land prices, because in the future rent will be an important factor which creates value in agricultural land (Kuchler, Tegene, 1993). After 1990, the transformation process in the Czech Republic led to high fragmentation in agricultural land fund ownership – c. 2.5 mil. owners (the number of owners who could fully use their property rights and deal with the land) – and thereby also an excess of supply over demand for agricultural land.

Moreover, the period 2001-2011 explains the quantitative changes in the agricultural land market after the law on the sale of state land was put into practice (1999) and after the accession of the Czech Republic to the European Union (Pletichová, Gebeltová, 2013). Sklenička et al. (2013) holds a similar opinion. The fragmentation of holdings, i.e. the fragmentation of land ownership, has resulted in considerable differences in the price of agricultural land in the CR and the EU-15 countries. This is one of the most powerful reasons why market prices remain at a low level. It applies particularly to land determined for agricultural activities, but also partly to land being purchased, when it is speculated that such land will be converted to a non-agricultural use, most often development. Skaloš (2010) states that spatial variability in the price of agricultural land is determined by factors which reflect agricultural use, and also by specific properties which are fundamental for the conversion of agricultural land to non-agricultural purposes. Although the motives for obtaining agricultural land for non-agricultural or speculative purposes are large, non-agricultural use of agricultural land is usually a less significant driving force behind the growth in agricultural land prices.

Researchers (Pandey, Seto, 2014) are investigating the influence of urbanization on the loss of agricultural land in India from 2001-2010. The analysis points out that the loss is more significant around small towns than large ones (min. 1 % loss of the agricultural land fund), in special economic zones, and in countries with a high rate of economic growth. An important conclusion is that the loss of agricultural land takes place mainly in countries with agricultural land of a higher quality. Since 2006, losses of agricultural

land have been steadily growing. Krushelnicki and Bell (1989) attribute the loss of agricultural land in Canada primarily to urbanization. The authors understand this fact as a persistent problem in managing the range of production resources and regulating land use. The authors put forward a price proposal, on the basis of which it is possible to identify possible changes in land use before they occur, and furthermore to redirect urban growth to less qualitatively significant parts of the country. A detailed spatial analysis of changes in landscape coverage was made by Angonese and Grau (2014) in suburban areas of subtropical Argentina from 1972 to 2010. The total change in land cover is characterized by the enlargement of cities and a 10 % growth in forested areas by means of mountain pastures, which lost 66 % of their original area.

Land use change is the result of human–environment interactions across a range of spatial and temporal scales. An analysis of changes in this system, e.g. as result of changes in agricultural policy EU, therefore requires an integrated perspective addressing both the geographic and economic dimensions of change. Different approaches have been developed in recent years to link the spatial and economic aspects of land chase (Britz et.al., 2011). Changes in land-cover type are possibly the clearest and most informative indicators of a change in state and characteristics of the environmental systems (Robson and Berkes, 2011). For these reasons, systematic monitoring and assessment of land-cover dynamics are recognized as sources of highly relevant information for planning, conservation, and management of the environment (EEA, 2010).

Materials and methods

1. The paper was elaborated on the bases of the following materials:

- Research reports and investigations of the Institute of Agricultural Economics and Information (IAEI) in the area of the statistical evaluation of the state of the agricultural land fund for the period 1990-2013
- Czech Report on the state of agriculture, Ministry of Agriculture, (MoA, 2006, 2012)
- Czech Situation and Outlook Report – Land (CSOR, MoA, 2009, 2012)
- Yearbook of Agricultural Land Resources, Czech Office for Surveying, Mapping and Cadastre (COSMC, 2002-2014)
- Czech Statistical Office (CzSO, 2014)
- Database FAOSTAT-Agriculture (FAO, 2014)
- Farm Accountancy Data Network (FADN, 2014)

2. Relationships, methods and procedures used

- Basic research methods are used in the paper: the method of secondary data collection, analysis and synthesis of documents, comparison, qualified estimation, the time series method and basic indices.
- The paper uses the software programme Microsoft Excel 97. A regression and correlation analysis will be done based on work with this program.
- The first level of the monitoring of changes in the use of agricultural land will be carried out at the CR level for the period 2001-2013, in which changes in the state of selected kinds of agricultural land (arable land, permanent grasslands) as well as total agricultural land will be analysed. The results will be compared with selected EU states and countries closely adjoining the CR (Visegrad Four).
- The second level of investigation will be carried out at the level of 14 regions: a) a change in the state of particular kinds of agricultural land, b) according to the criterion "price of agricultural land by Classified Soil-Ecological Units (CSEU)" and decrease in agricultural land in a specific CR region, c) "rent per hectare of agricultural land". The evaluation will be carried out in regions with above-average and the lowest values of rent. The results will be compared with the CR average.
- The third evaluation of changes in the state of selected kinds of agricultural land will be carried out at the level of the lowest territorial division – at the district level. These districts will be chosen based on the intersection of three criteria (the official land price, the market land price, and a percentage of arable land) which qualitatively determine the best areas in terms of land value. In the selected collection of regions, a time series analysis will be carried out. Its aim will be to find out the extent to which agricultural land is degraded by being changed into other cultures or converted to non-agricultural use, and at the same time experiencing a change in natural fertility (according to updating

of the CSEU value) (Voltr, in MoA, 2012b). Within the framework of the above-mentioned territorial division, the investigation will be elaborated more deeply to include lower administrative units (units with an extended territorial scope). Within the lower administrative units a regression analysis will be carried out, in which a dependent variable y = the relative change in the extent of agricultural land in view of the acreage of the municipality for the period 2009-2013 (ha), and an independent variable x = the size of a territorial unit (number of inhabitants) in the year 2012.

Results and discussion

The price of agricultural land in the Czech Republic is significantly lower than in other EU states; however, the land's fertility and method of cultivation does not differ too much from surrounding countries. The area of agricultural land in the CR decreases by about 12 ha/day (MoA, 2012). Based on developments in recent years, one can expect prices of agricultural land to rise, also on account of a gradual equalization with the EU states. However, it can be predicted that the growth will be gradual.

The interest in agricultural land is increasing in connection with the provision of direct payments paid per hectare of agricultural land, and also in connection with an increased interest in the growing of energy crops. On account of the described changes in agriculture which occurred after 1989 (Pletichova, Gebeltova, 2013), 76 % of agricultural land in the CR is today under the management of tenants, not owners. In 2000, as much as 84 % of farmland was rented; in 2010 this share amounted to 78 %, and in 2012 it was 76 %. The share of rented land to total land area in Czech agriculture is, after Slovakia, the highest of all EU countries (MoA, 2012a).

1. Quantification of changes in the agricultural land fund for 2001 – 2013 at the CR level

As in the entire EU, the area of agricultural land in the CR is decreasing. Arable land is losing its value, in terms of land as a production factor. Besides natural soil degradation, this includes conversion of arable land into perennial cultures and permanent grasslands, the outplanting of fast-growing woody plants, afforestation, etc. We are led to believe that photovoltaic power stations are built only on poor-quality soil on sloping land. On the contrary – power stations are often situated on land with a high classification value and, at the same time, they degrade the landscape. Brownfields are used insufficiently. The quality of agricultural land is decreasing with the growing rate of erosion. The state of land in the EU is currently being discussed in reports made by the Joint Research Centre (JRC) and the European Commission. "It is clear that if we want to continue not only producing food in Europe but also preventing flooding or, vice versa, resisting droughts and climate change, and also supporting biodiversity growth, the EU must take legislative action for the protection and sustainable use of land in Europe" (EU, 2012).

The states of agricultural land in the Czech Republic, including selected kinds of agricultural land, changed from 2001 to 2013 in the following way (Table 1): The total acreage of agricultural lands registered in the Land Register of the CR decreased by 57,568 ha (a decrease of 1.35 %); arable land decreased by 89,386 ha (-2.91 %), and this decrease was largely transformed into an increase in permanent grasslands (an increase of 2.96 %). Graph 1 shows detailed year-on-year daily changes in agricultural land, as well as changes for the period 2001-2013 in the CR (Table 2).

In an international comparison with European states, a change in the area of agricultural land[1], a similar result as in the CR in the monitored period 2001-2013, is obvious in France (-1.83), where the daily decrease in agricultural land is 135 hectares; however, in acreage the agricultural land is 6.8 times larger than in the CR. In Germany, the decrease in agricultural land in the period 2001-2013 amounts to 1.85 % of agricultural land, which represents 78 ha/day (3.9 times larger than the acreage of agricultural land in the CR).

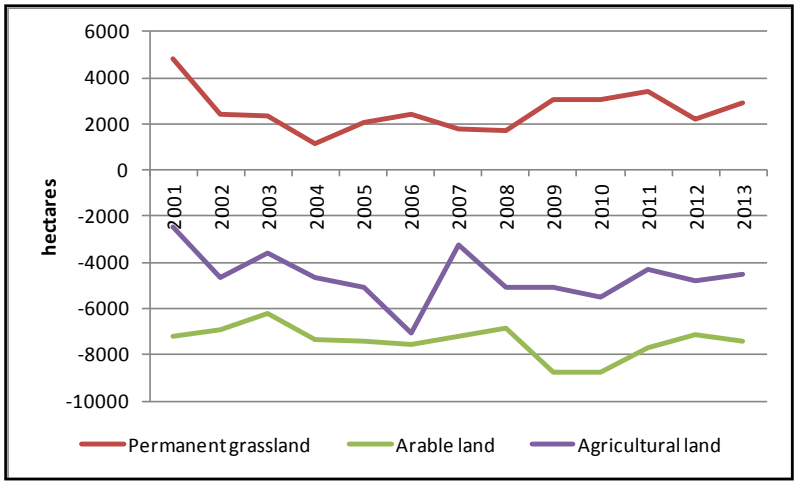
One neighbouring country which, in light of its position and closeness of its border, can compete in agricultural production with the Czech Republic is Poland, which recorded a decrease in the same period, 16.92 %. The decrease represents a significant change in the state of agricultural land (hereinafter only AL), -749.44 ha/day, which is explainable by 3.5 times the AL acreage towards the CR, but not positive.

[1] Source: Own calculations according to FAO, 2014 monitored period from the years 2001-2013

Agricultural land thous. (ha)	2001	2002	2003	2004	2005	2006	2007
Permanent grassland	966	968	971	972	974	976	978
Arable land	3 075	3 068	3 062	3 055	3 047	3 040	3 032
Agricultural land	4 277	4 273	4 269	4 265	4 259	4 252	4 249
Year		2008	2009	2010	2011	2012	2013
Permanent grassland		980	983	986	989	992	994
Arable land		3 026	3 017	3 008	3 000	2 993	2 986
Agricultural land		4 244	4 239	4 234	4 229	4 224	4 220

Source: Land Fund Yearbook 2002-2014, COSMC Prague

Table 1: States of acreage of selected kinds of agriculture land in 2001-2013.



Source: Own calculations according to Land Fund Yearbook 2000-2014, COSMC Prague

Graph 1: Average annual change in the acreage of agricultural land and its selected kinds for the period 2001-2013 (hectares)

	2001-2013	2001-2013	2001-2013	2001-2013
Agricultural culture	Average annual change (ha)	The average daily change (ha)	Absolute change (ha)	Relative change (%)
Permanent grassland	2,569	7.13	28,579	2.96
Arable land	-7,430	-20.64	-89,386	-2.91
Agricultural land	-4,616	-12.82	-57,566	-1.35

Source: Own calculations according to Land Fund Yearbook 2000-2014, COSMC Prague

Table 2: Changes in the states of agricultural land for the period 2001-2013.

Hungary, with a comparable acreage of agricultural land to the CR (1.26 times) recorded a decrease in AL by 9 % and a daily decrease in AL of 131.50 ha, a result which does not sound optimistic. Values in Slovakia are alarming as well (decrease in the monitored area of 14.43 % of AL; daily decrease in AL of 81.02 ha). These data also sound negative in relation to the acreage of agricultural land in Slovakia, which is at the level of 45 % of the acreage of agricultural land in the CR (FAO, 2014).

2. Change in the state of agricultural land at the level of 14 CR regions

a) Change in the state of particular kinds of agricultural land

Of the total acreage of 4,277,435 ha (2001) of agricultural land in the CR, there was a decrease of 57,568 ha (1.346 %), and the present acreage of agricultural land (2013) is 4,219,867 ha. The area of arable land in the CR in 2001 was 3,075,178 ha, and by 2013 (2,985,792 ha) this

had decreased by 89,386 ha. This was largely due to its conversion into permanent grasslands (PGG), forested areas and non-agricultural use.

There was a decrease in agricultural land in all monitored regions. A more significant decrease was recorded in the Prague region, the capital (-5.43 %), Highlands region (-2.73 %) and Moravia-Silesia region (-3.18). The area of the Olomouc region recorded an increase of 0.69 %.

An evaluation of the decrease in agricultural land in particular regions has to be carried out not only with the help of values of the physical decrease in ha, but also in relation to the total change in the region's acreage in the monitored period. There were significant changes in the extent of the area of regions[2] in 2004-2005, in the regions of Highlands, South Moravia, Olomouc and Moravia-Silesia. Significant deviations from the CR average were found by calculation, just in these regions (Table 3).

The impact of the change in a region's acreage on the percentage change in the acreage of agricultural land (Table 3) in the monitored regions and years (2004-2005) is as follows[3]:

The Highlands region registered a significant decline in the extent of agricultural land in 2001-2013 (2.731 %), which differs considerably from the CR average (1.346 %) (Table 3). However, in 2004-2005 there was a decrease in this region's acreage by 12,982 ha (1.87 %). This change is also reflected in the acreage of particular agricultural crops. In relative terms, the extent of agricultural land has improved. The share of agricultural land in the region's acreage in 2004-2005 increased from 60.58 % to 60.69 %.

The South Moravia region, with a change in the state of agricultural land of +0.3 % (Table 3), achieves even better results in relative terms. In 2004-2005, the extent of this region increased by 12,959 ha (+1.83%). In relative terms in the mentioned years, the share of agricultural land in the region's acreage increased by 53,515, to 59.97 %.

The acreage of the Olomouc region increased by +2.08 % in 2004-2005; however, the ratio between the agricultural land and the region's acreage did not change significantly (+0.02 %). The result is confirmed in Table 3.

Values for the Moravia-Silesia region do not look optimistic in comparison with the national average. The total acreage of the region decreased (-1.95 %) as well as the share of agricultural land in the region's acreage (-0.23 %).

[2] Belonging of municipalities in district of administration was adjusted to the 1.1.2005 by a new regulation of the Ministry of Internal Affairs No. 388/2004 Col. from 24.6.2004 which change the regulation from 2002. Changes happened in determination of districts of administration.

[3] Sources: Calculations of authors according to yearbooks of agricultural land fund 2005 and 2006 (CSMC)

region	Change in AL		Change in PGG		Change in AgL	
	ha	%	ha	%	ha	%
Central Bohemian	-9904	-1.774	1633	2.331	-8012	-1.196
South-Bohemian	-9693	-3.022	3384	2.103	-6111	-1.232
Pilsen	-9147	-3.445	3543	3.356	-5563	-1.447
Karlovy vary	-3418	-5.957	2108	3.275	-1362	-1.086
Ústí	-6230	-3.322	3811	5.542	-3037	-1.091
Liberec	-5834	-8.244	4552	7.434	-1205	-0.855
Hradec Králové	-3618	-1.860	594	0.848	-3015	-1.075
Pardubice	-4774	-2.368	1507	2.525	-3327	-1.212
Highland	-9876	-3.028	-1319	-1.582	-11488	-2.731
South-Moravian	-6668	-1.855	1818	6.464	-1294	-0.303
Olomouc	-4542	-2.152	6482	12.939	1899	0.685
Zlín	-4950	-3.905	1573	2.826	-3013	-1.537
Moravian-Silesian	-9724	-5.405	-1103	-1.267	-10891	-3.817
City Prague	-1010	-6.487	-4	-0.458	-1149	-5.431
Total CR	-89 386	-2.907	28 579	2.959	-57 568	-1.346

Note: AL – agricultural land, PGG – permanent grass growths, AgL – agricultural land, Base = year 2001
Source: Authors according to Land Fund Yearbook 2002-2014, COSMC Prague

Table 3: Change in the acreage of agricultural land, arable land and permanent grassland in the regions in the years 2001-2013.

A significant decrease in agricultural land in the capital city of Prague (-5.43 %) is not due to a change in the region's total acreage, but to the conversion of agricultural land to non-agricultural use.

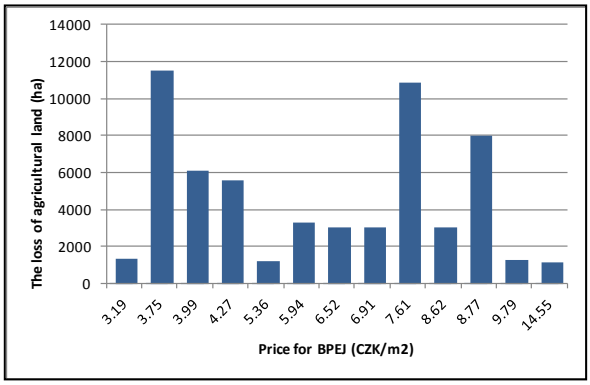
A change in the size of the cadastral areas of the CR was addressed in the research „Land Use Land Cover Change" under the auspices of the international commission IGU LUCC (International Geographical Union – Commission on Land Use and Land Cover Change) (Bičík, 2010). The database created within the framework of this research represents a collection of 8,903 BTU (Basic Territorial Units), covering the whole Czech Republic. BTUs were created by combining cadastres whose acreage had not changed significantly during the monitored period (by not more than 1 %).

b) Change in the state of agricultural land in the CR regions in confrontation with the price of agricultural land for CSEU

Region	price for CSEU[1)] in CZK/m^2	Decrease in AgL[2)] in ha
Karlovy Vary	3.19	-1 362
Highland	3.75	-11 488
South-Bohemian	3.99	-6 111
Pilsen	4.27	-5 563
Liberec	5.36	-1 205
Pardubice	5.94	-3 327
Ústí	6.52	-3 037
Hradec Králové	6.91	-3 015
Moravian-Silesian	7.61	-10 891
Zlín	8.62	-3 013
Central-Bohemian	8.77	-8 012
Olomouc	7.45	1899
South-Moravian	9.79	-1 294
City Prague	14.55	-1149

Source: [1)] Voltr (IAEI), In: MoA, (2012b), official price for 2012
[2)] Authors according to Land Fund Yearbook 2002-2014, COSMC Prague
Table 4: Change in the state of agricultural land in the CR according to region (2001-2013) and evaluation of agricultural land on the basis of CSEU.

A negative phenomenon is that the more significant decreases happen even on land of better quality (an evaluation according to the average official price on the CSEU base (CSEU - Classified Soil Ecological Unit)), i.e. with official prices 7.61 CZK/m^2 and 8.77 CZK/m^2.



Source: Authors according to Voltr (In: MoA, 2012b), Land Fund Yearbook 2002-2014, COSMC Prague
Graph 2: Loss of agricultural land in 2001-2013 according to official prices in 2012 (monitoring in CR regions)

c) Evaluation of agricultural land in terms of rent

Rent is one of the cost items which influences the profitability of the economy. It is therefore simultaneously an expression of the interests of land owners on the one side, and of enterprising subjects on the other. In another investigation, a rent value was used (CZK/ha, EUR/ha) as a criterion of the interest (preference) in the use of agricultural land for entrepreneurial activity. The level of rent takes into account not only the fertility of agricultural land, but also the amount of claimed subsidies (SAPS, national payments, payments from the Rural Development Programme), attractiveness of the area (suburban area) and proximity to the neighbouring country. The evaluation was carried out in six regions with above-average values of rent and three regions with the lowest rent values.

The average rent in the CR moves within a range of 2 % of the official price (MoA, 2012a). With the average official price of agricultural land at 6.23 CZK/m2 (CSOR land, 2012), it is possible to consider 1,246 CZK/ha (48.85 EUR/ha) as the average level of rent. In another investigation, regions which reach higher than average rent levels were chosen. Of the 14 CR regions, six were selected for the evaluation: Olomouc, Central Bohemia, Ústí, Zlín, South Moravia and Hradec Králové (Tables 3, 5). The regions account for 53.7 % of the acreage of the CR. The region of Ústí, which is mostly an LFA (less favoured area), also falls within the set of regions. There, the rent level is influenced not only by the fertility of the rented agricultural land, but also by the amount of subsidies and the fact that it is a border area with Germany.

	Region	CZK/ha	EUR/ha
1	Olomouc	1 980.79	77.663
2	Central-Bohemian	1 738.27	68.154
3	Ústí	1 528.92	59.946
4	Zlín	1 528.20	59.918
5	South-Moravian	1 505.02	59.009
6	Hradec Králové	1 292.84	50.690
7	Highland	1 230.02	48.227
8	Moravian-Silesian	1 207.53	47.345
9	Pardubice	1 202.37	47.143
10	Jihočeský	1 168.02	45.796
11	Karlovy Vary	1 156.17	45.331
12	Pilsen	980.54	38.445
13	Liberec	786.72	30.846
14	Prague*)	x	x

Note: *) In the FADN network was not able to find out data (the database provides data of less than 3 enterprises)
Source: FADN, 2014, exchange rate CZK/EUR for 2012: 25,505 CZK/EUR

Table 5: Level of rent (price per ha), CR regions, 2012.

In the selected regions, which represented agriculturally important land, it was found that:

- The decrease in arable land of 2.19 % is comparable with the national average. However, it is essential to take into account that this is land of considerably higher quality.
- In the case of the conversion of arable land into permanent grasslands, the evaluation is not always unambiguously negative, because an increase in PGG acreage is considered positive in terms of anti-erosion measures. In the selection of plots for non-agricultural purposes, the importance of arable land should be accepted and its extraction from the agricultural land fund should be reduced. At the same time, it is also necessary in this regard to structure the territorial plans. Within the strategy, the territorial plans should support the development of housing construction and infrastructure, but within the context of sustainable agriculture. The largest decreases in arable land in particular regions were detected in the region Zlín (63 % of arable land) and the region Ústí (65 % of arable land). The increase in PGG in the monitored area of the six regions significantly exceeds CR values. The value increase of 4.6 % is influenced mainly by the Olomouc region. There was an increase in PGG of 89 % in 2004-2005, which was influenced by a 2 % increase in the region's total area.
- The decrease in agricultural land, meaning the land acreage which is irreversibly excluded from the agricultural land fund in selected regions, is lower in comparison with the nationwide decrease. This is a positive result. The smallest decreases are observed in the South Moravia region. According to the class of soil, the highest average official price of all CR regions (5.23 CZK/m2) is assigned to this region, and the results correspond with the law concerning protection of the agricultural land fund.

According to the criterion "rent in CZK/ha", the regions Hradec Králové, Pilsen and Liberec were in the last three places (Tables 3, 7).

Use of agricultural land in areas with the lowest rents and, at the same time, with low official prices (Table 7):

- The percentage value of PGG acreage in the monitored areas is significantly higher than the CR average. In these areas, PGG supports the reduction of land degradation through erosion. The mentioned regions are among the LFA areas of the CR. The share of LFA land in the Pilsen region represents 15 % of the less favourable areas of the CR. In the region of Karlovy Vary, 52 % of the land is managed in less favourable areas for agriculture of the entire CR, and in the Liberec region it is 3.5 % of the LFA acreage of the CR[4].
- The development of the decrease in arable land in the monitored period by CR region is considerably higher than the CR average; however, farming on lower-quality lands is not economically advantageous. Through the conversion of arable land to PGG, protective elements are preferred as well as less invasive management of agricultural land.
- The decrease in agricultural land in these regions does not differ significantly from the CR average.

In addition to the change in acreage of particular kinds of agricultural land, there are also changes in the production capability of land. Changes in the average official price in the monitored CR

[4] Source: MoA, 2012a

Agricultural land according to cultures	Arable land		Permanent grassland		Agricultural land	
Selected region of the ČR	Absolute change (ha)	Relative change (%)	Absolute change (ha)	Relative change (%)	Absolute change (ha)	Relative change (%)
The selected region:	**-35900**	**-2.19**	**15911**	**4.618**	**-16472**	**-0.772**
Total for Czech Republic	**-89386**	**-2.907**	**28579**	**2.959**	**-57568**	**-1.346**

Source: Own calculations according to the Agricultural Land Fund Yearbook 2002-2014, COSMC, Prague

Table 6: Decreases in the agricultural land of six selected regions in 2001-2013.

Agricultural land according to cultures	Arable land		Permanent grassland		Agricultural land	
Selected region of the ČR	Absolute change (ha)	Relative change (%)	Absolute change (ha)	Relative change (%)	Absolute change (ha)	Relative change (%)
The selected region:	**-18387**	**-4.647**	**10215**	**4.381**	**-8130**	**-1.249**
Total for Czech Republic	**-89386**	**-2.907**	**28579**	**2.959**	**-57568**	**-1.346**

Source: Own calculations according to the Agricultural Land Fund Yearbook 2002-2014, COSMC, Prague

Table 7: Three regions with the lowest rent value (regions Hradec Králové, Pilsen, Liberec).

regions according to the updated CSEU were published by Voltr (Moa, 212 b). The research of the authors of this paper shows that decreases in agricultural land also happen in regions where official prices according to the updating of CSEU are increased (e.g. the region Hradec Králové). In addition to the degradation of agricultural land by the decrease, degradation is also caused by a loss of the production capability of the land. Examples include the South Moravia region (the original official price[5] is 9.79 CZK/m^2, after updating 8.75 CZK/m^2), Moravia Silesia region (the original official price is 7.61 CZK/m^2, after updating 7.35 CZK/m^2), Olomouc region (the original official price is 7.45 CZK/m^2, after updating 7.02 CZK/m^2) and Zlín region (the original official price is 8.62 CZK/m^2, after updating 7.74 CZK/m^2).

3. 3. Evaluation of changes in the state of agricultural land at the level of lower administrative units

a) Evaluation on a district basis

The third evaluation of the importance and quality of agricultural land was carried out at the CR district level, i.e. at the level of lower territorial divisions. The specific selection of districts was based on the simultaneous fulfilment of the three criteria (conditions) mentioned below. The criteria have the value of the CR average, and selected districts must take a value above its level. There are also some data available from the following years; however, the chosen criteria were available concurrently only for the year 2007.

The criteria in the CR (average values for 2007):

1. the official price ≥ 5.24 CZK/m2 (source: MoA regulation No. 287/2007 Col., In: MoA, 2009, Appendix 1, pp. 66-67)
2. percentage of arable land ≥ 71.3 % (source: CSOR- land, 2009, p. 7)
3. market price 3.735 CZK/m2 (source: MoA, 2009, p. 78, Appendix 6; price map, IAEI, 2007, In: MoA, 2009, p. 46)

The number of districts which fulfilled the chosen criteria:

1. criterion /official price/ 30 districts
2. riterion /percentage of arable land/44 districts
3. criterion /market price/ 25 districts

Number of CR district: 78

In the intersection of the selected criteria, the resulting number of districts was found to be 21; they occupy acreage of 1,272,463 hectares, which corresponds to 30.15 % of the acreage of the agricultural land of the Czech Republic (data from 2013). In the sample, six districts were included from the Central Bohemia region, two districts from the Hradec Králové region, three districts from the Pardubice region, and five districts from the South Moravia region. The Olomouc region is represented by three districts, Ústí by one district. The last district is the City of Prague. In the 21 selected districts, the classification was

[5] Price of agricultural land in the cadastral area before the updating of CSEU in the CR (2012)

focused on evaluating changes in the acreage of agricultural land from 2001-2013, which indicates that agricultural land increased in three districts (Prague – east, Hradec Králové, Brno – country, and Olomouc). It would also be appropriate in this case to make a quantitative evaluation of the decrease in agricultural land in relation to district size6. In seven districts of the sample there was a reduction of the district, mainly due to territorial changes in 2006-2007. In six districts, an increase in the acreage of the districts could be observed (changes in 2004-2005 and 2006-2007). In cases where the change was smaller than 1,000 ha, the area was understood to be "without change in acreage" (Table 8).

The decrease in the share of agricultural land to the size of the investigated districts in the CR for the period 2001-2013 was 1.248 %. Of the 21 evaluated districts, 13 have a decrease smaller than this, which represents 61.64 % of the acreage of agricultural land of the examined districts. Growth in the share of agricultural land in the district acreage was recorded in 3 districts (Kolín, Přerov, Brno – country); in the other 18 districts, a decrease was observed in the share of AgL in the district acreage (Table 8). The highest positive value for the change in AgL share in the district acreage was 3.1 % (Kolín), and the largest negative change was -6.37 % (Prague – east).Evaluation on base of municipalities with extended scope (21 districts = 56 municipalities)

b) Evaluation based on municipalities with an extended scope (21 districts = 56 municipalities)

Twenty-one districts were further evaluated at the level of 56 municipalities with an extended scope. These included Prague, the Pardubice region (5 municipalities), Ústí (3 municipalities), Olomouc region (9 municipalities), South Moravia region (18 municipalities), Hradec Králové region (5 municipalities) and the Central Bohemia region (15 municipalities). A partial aim in this more detailed assessment was to determine, through detailed regression analysis, whether there is a relationship between the size of municipality (according to number of inhabitants) and a change in the acreage of agricultural land, especially with regard to decreases.

In the monitored sample of 56 municipalities, which represent the classification (CSEU) and market value (price per m2) of valuable CR areas, a significantly strong tightness of dependence was not proved between the level of change in the share of agricultural land and the extent

	Number of districts	Acreage of respective AgL 2013 (ha)	% of respective acreage of AgL on acreage of 21 districts
Decrease of AgL caused by decrease of district, share of AgL/district acreage grows	2	114051	8.96
Decrease of AgL caused by decrease of district, share of AgL/district acreage decreases	7	453845	35.67
Decrease of AgL without change in district acreage, share of AgL/district acreage decreases	7	353352	27.77
Decrease of AgL with increase of district acreage, share of AgL/district acreage decreases	1	69062	5.43
Decrease of AgL was caused by increase of district, share of AgL/district acreage grows	1	84594	6.65
Decrease of AgL was caused by increase of district, share of AgL/district acreage decreases	3	197559	15.53
In total (21 districts)	21	1272463	100.00
Number of districts with growing change of share of AgL in district acreage	3	198645	15.61
Number of districts with decreasing change of share of AgL in district acreage	18	1073818	84.39
Number of districts with smaller decrease than is the CR decrease (1.248 %)	13	784556	61.64

Source: Own calculations according to the Agricultural Land Fund Yearbook 2002-2014, COSMC, Prague

Table 8: EEvaluation: Change in the share of agricultural land (AgL) in district acreage from 2001 to 2013 in 21 selected districts in the CR for the period 2001-2013.

of the municipality (y), and the size of the municipality according to number of inhabitants (x). This was defined by a linear regression function in the form:

$Y = 0{,}000000002x^5 - 0{,}0000005x^3 + 0{,}00004x^4 - 0{,}0015x^3 + 0{,}0272x^2 - 0{,}1708x - 0{,}2587$

$R^2 = 0{,}2695 = 26{,}95\%$

The presumption that the higher the number of inhabitants in a municipality the larger the decrease in the share of agricultural land in the district acreage was not proved for the selected municipalities. (Graph 3).

Conclusion

The decrease in agricultural land from both a quantitative and qualitative viewpoint is a natural phenomenon of every civilized society. With population growth, proportions of agricultural and non-agricultural land change. The aim of every state or society is to preserve natural wealth and its diversity for future generations and to ensure the sustainability of agriculture.

In the Czech Republic from 2001 to 2013 (Table 1), the state of agricultural land, including selected cultures, changed in the following ways: The total acreage of agricultural land registered by the Land Register of the CR decreased by 57,568 ha (a decrease of 1.346 %); the acreage of arable land decreased by 89,386 ha (-2.91 %), which was transformed mostly into an increase in permanent grasslands (an increase of 2.96 %). The authors carried out the evaluation not only at the national level, but also at the level of selected regions and municipalities. When assessing the decrease in agricultural land in particular regions, it was necessary to carry out the evaluation not only using values of absolute decreases in hectares, but also in relation to the total change in the acreage of the region in the monitored period. There were significant changes in the acreage of some regions in 2004-2005, and this was clearly reflected in changes in the state of agricultural land in these regions. In evaluating absolute changes in the acreage of agricultural land within a region, it is also necessary to take into account changes at the regional level. The research further shows that one negative phenomenon is that higher decreases in agricultural land also occur on land of better quality (evaluation according to the average official price (5.24 CZK/m^2) based on CSEU), i.e. with official prices of 7.61 CZK/m^2 and 8.77 CZK/m^2. A more detailed investigation carried out by Voltr. (decreases in agricultural land occurred from 1995-2012, according to prices of agricultural land using classified soil ecological units (CSEU) at the level of the cadastral areas of the CR) led to the conclusion that in a proportional organization, according to the acreage of agricultural land in particular price categories, there is a higher relative decrease on lands of better quality near cities (Voltr, In: MoA, 2012b).

The authors´ research indicates that the relative decrease (0.77 %) in qualitatively better agricultural land from 2001-2013 in the selected regions (50.1 % of the agricultural land fund of the CR) is smaller in comparison with the nationwide decrease (1.346 %). This is a positive result. The relative decrease in arable land in these areas (2.19 %) is comparable to the national average. However, it is essential to bear in mind that this is land of significantly better quality. The development of the decrease in arable land (%) in the three quantitatively worst regions of the CR (Karlovy Vary, Pilsen, Liberec) in the monitored period is significantly lower than the CR average; however, farming on lands of lower quality is not economically advantageous. Through the conversion of arable land into PGG, protective elements are preferred as well as less invasive management of agricultural land. The decrease in the share of the agricultural land fund (21 studied districts) in the size of the investigated districts in the period 2001-2013 was 1.248 %. Of the 21 evaluated districts, 13 have a decrease lower than this, which represents 61.64 % of the agricultural land acreage of the examined districts. Growth in the share of agricultural land in the district acreage was recorded in three regions (Kolín, Přerov, Brno – country). In the other 18 districts, a decrease in the share of agricultural land in the district acreage was recorded (Table 8). It is not possible to consider that in the future, values of relative changes in the shares of agricultural land in the area of the municipality will increase. However, it is necessary to be mindful of their modest and stable development.

One partial aim was to find out whether there is a relationship between the size of municipality (according to number of inhabitants) and a change in the acreage of agricultural land, especially with regard to decreases in agricultural land in the selected 56 municipalities. Here, however, the regression analysis did not prove a strong tightness of dependence between the quantities.

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