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The future of grasslands and beef cattle in the Czech Republic

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Abstract

Grasslands received policy attention in the Czech Republic only just fifteen years ago, when they were threatened to be abandoned in the economic transition process. The supports to farming on grasslands have grown gradually, particularly after the EU accession. The policy followed the notion of jointness between grassland management and beef cattle raising and conditioned AE and LFA payments by a minimum livestock density. There are many reasons why the current policy will change in the new programme period. The paper tries to assess the impact of the envisaged changes on grassland maintenance. It is showed that overall future supports to farming will be sufficient to keep positive profit on grassland farms, however the structure of supports might be less appropriate to the actual objectives of grassland protection and hence, there is a threat of policy failure in the end.

Keywords: grasslands, beef cattle, mathematic programming model

JEL classification: Q20, Q28.

1. INTRODUCTION

Grasslands received policy attention in the Czech Republic only just fifteen years ago, when they were threatened to be abandoned in the economic transition process. Beef production dropped due to the collapse of demand by 40 % between 1990 and 1995 and with it the cultivation grasslands. From the very beginning the support to grasslands was linked to extensive beef production. However, there were almost no beef cattle produced before 1995; raising beef cattle was stimulated by several measures since that: by the minimum livestock density condition for the grasslands maintenance support and LFA payments, specific Top-ups, article 68, the support to organic beef and a specific investment support. In 2011 (2010), there were 183 thousand (167 thousand) suckler cows, 700 thousand hectares of grasslands under the maintenance support (MoA, 2012). The average of all area supports per hectare of grasslands amounted 15 thousand CZK (approximately € 600) in 2011. In spite of terrible unprofitability of the extensive beef production, such a support is perceived to be inadequate, generating excessive profits particularly on large extensive farms (Doucha et al. 2012).

The objective of the paper is to discuss and to assess options of grassland maintenance scheme under CAP2020 reform. In turn it means i) to evaluate social and private costs and benefits of the current policy; ii) to discuss the conceptual approach to grasslands maintenance including biodiversity conservation, landscape protection and jointness of them with extensive beef production; iii) to develop scenarios of policy options deploying new and old instruments of Pillar 1 and 2 of the CAP 2020.

The paper is structured in 8 parts. The overall approach is presented in the next paragraph. In paragraph 3 we discuss the social value of grasslands and after that we give the

notion on the distribution of grasslands in the country. The current beef production on grasslands is presented in paragraph 5. It also includes a simple cost benefit analysis. In paragraph 6 we introduce the farm model and in the following section the scenarios. Results are presented in paragraph 7. The findings are summed up in the final paragraph.

It is vital to stress that the paper refers to the on-going research and that the presented results are still to be taken as provisional.

2. METHODOLOGY

The cost benefit analysis (Guess, Farnham, 2000) is based on the FADN data, special production costs survey of UZEI, beef market data, soil quality database, earlier WTP and WTA valuation of landscape conducted by UZEI and expert knowledge. To assess the scenarios we applied a regionalised farm model (FARMA 4x) based on mathematical programming approach. In this model, the number of farm types cultivating grasslands was extended (to 6) to portray well various soil and climatic conditions; each farm type assumes two or more optional production and conservation technologies on grasslands (see paragraph 6). The quantitative analysis is completed by two qualitative case studies.

3. VALUE OF GRASSLANDS

Grasslands have a particular value in the Czech Republic where 71,1 % of agricultural land is arable land while grasslands extent on less than a quarter (23%) of it (Ministry of Agriculture 2011). At the same time there is quite a high proportion of forests in the country - 33,7 % (Czech Statistical Office 2011) of the national territory. Therefore, there is a need for more grassland from environmental point of view in general. Especially in mountain areas, each meadow is of high ecological value as a factor of diversity of habitats and open space. But also in the other parts of the country grasslands are needed: a lot of arable fields extends on steep slopes accelerating soil erosion in sub-mountain areas while crop yields are relatively poor; there are fertile areas with small number of landscape features where grassland adds to the ecological stability; etc..

The Czech population value the landscape management predominantly induced by grassland maintenance and provided by farmers high; According to the contingence valuation survey carried out by UZEI in 2010 (Majerova, Wollmuthova, 2011), Czech citizens are ready to spend for an additional hectare of grasslands between 167 –424 EUR (WTP valuation) and accept compensation of 435 - 768 EUR for a hectare lost (WTA)[1]. This survey also showed that the Czech population preferred that the landscape was maintained by farmers and with the public funds support. The high social value of grasslands is recognised by the law and their conversion to arable land is very limited (practically prohibited).

[1] These figures have to be taken with caution, since they are recalculated from the reported figures of willingness of citizens to pay (per capita and annually) for landscape maintenance (a loss of it) where grasslands dominated as the main landscape amenity.

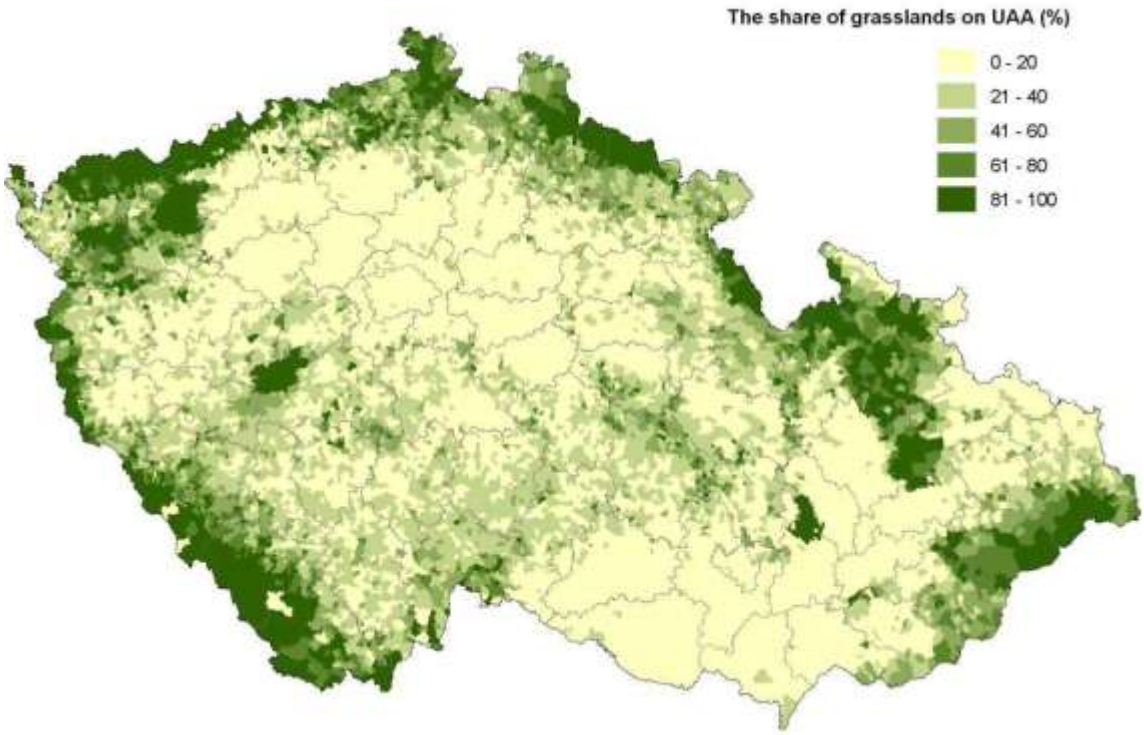
There are two contrasting threats to grasslands: in some areas, insufficient management or abandonment and in the other areas, excessive intensification. The grasslands were threatened by abandonment much more than any other type of land use in the 1990s, after the decline of the beef and milk markets. Nowadays, about a third of the grassland area is cultivated only due to supports of all kind (DP, LFA, AEM). It means, the threat that grasslands are overgrown by shrubs and trees exacerbates if the supports are cancelled or substantially reduced. .

The current targeted support to grassland is consists of agri-environmental measure, e.g. support of grassland management and in many cases of payments for grassland management under organic farming.

4. TERRITORIAL DISTRIBUTION OF GRASSLANDS

As shoved in Figure 1 grasslands are distributed predominantly in mountain and sub-mountain areas. In general, the higher altitude the higher share of grasslands on UAA. The exception is the west and particularly the north-west part of Bohemia, where high shares of grasslands are also in lower altitudes. This is associated with the collapse of farming after the disruption of state farms[2].

Figure 1 The share of grasslands on UAA

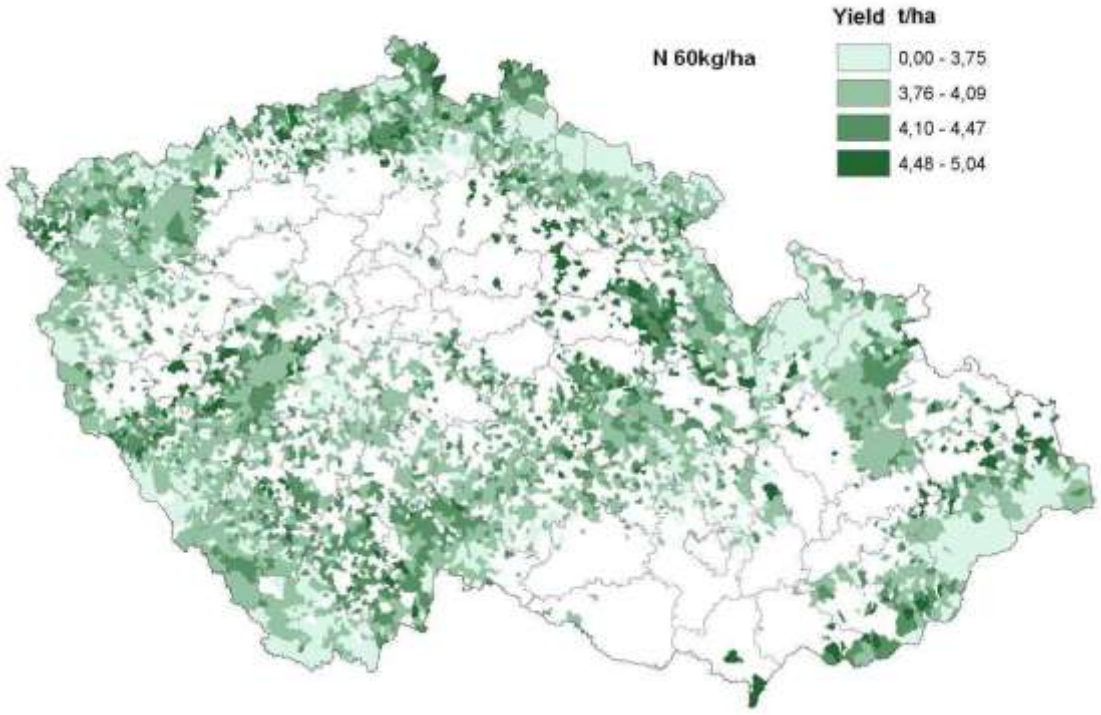


Source: LPIS 2011, own processing

[2]There are also deeper roots in the history, these were areas predominantly populated by Germans. After their exodus, attachment to farming deteriorated.

Yields decline with the altitude too (Figure 2). However there are two other factors affecting yields: water availability (reins) and application of fertilisers. In western Bohemia, yields are high even in high altitudes due more Atlantic climate with sufficient reins. In contrast, in East Moravian mountains climate is dry and yields are rather poor.

Figure 2 Distribution of grass yields (in the hay equivalent)



Please note that yields are displayed only for cadastres with more than 20% of grasslands.

Source: Voltr et al. 2012

Concerning the application of fertilisers UZEI carried out an extensive survey on the cultivation of grasslands in 2011 (UZEI 2011). In total 588 farms with grasslands were interviewed. It revealed that the intensity of input use had decreased significantly since the beginning of the 1990s. The application of nitrogen did not exceeded on average 30 kg per hectare during the last few years; corresponding yields are substantially below (of 20%) their potentials. The survey also disclosed that there were not big differences in application of fertilizers between farms which took part in the agri-environmental measure (grasslands maintenance) and those who stayed outside.

5. BEEF CATTLE ON GRASSLANDS

Beef cattle on grasslands became within a short period an important part of domestic cattle herd. Whereas even in the early 1990s the cattle herd completely linked to dairy cows,

suckler cow herd grew amazingly so that suckler cows share on the total number of cows amounted a third of the total cow herd in 2011(Table 1)[3].

Table 1 Cattle herd (´000 head) development

	´00	´01	´02	´03	´04	´05	´06	´07	´08	´09	´10	´11
Suckler-cows	67	82	100	124	136	141	140	154	163	177	169	188
Dairy cows	548	529	496	466	437	433	423	410	403	394	378	374

Source: CzSO, Register of production animals

The rapid development of the beef herd is to be understood as an effect of abandoning productions not convenient for poor soils converting land in grasslands, together with a governmental policy supporting this branch and partly as an effect of marketing opportunities emerged by the accession to the EU market. The suckler cows´ herd amounted 188 thousand head in 2011, most of it being located on grasslands (MoA, 2011). There is to mention that in the country the bull finishing is split from cow-calf farms; the cow-calf farms are typically on grasslands while bull fattening is traditionally is in sheds. This pattern has resulted from the earlier production system based on dairy cows as well as from market opportunities for selling young bulls.

As the production system is concerned, an important part of cow-calf farms make the husbandry in the organic way; in 2010 almost 80 thousand suckler cows were raised in the organic farms (ČSÚ, 2011). To finish the animals on organic cow-calf farm (being scarce in arable land) means either to finish them by own silage and hay or to purchase the organic concentrate feeds, both ways being costly and thus inefficient.

The domestic consumer demand for beef meat is rather limited (9 kg/per capita and year) and the more for organic one. This is from different reasons; primarily it is the high price combined with the lack of cooking skill what discourages most of the consumers to buy meat of beef cattle. Thus the weaners[4] coming from pastoral farms (either organic or not) are often sold abroad. Young stocks find mature markets in the near EU countries like Italy, Germany, Netherlands and Austria where finishing farms provide usually much better price in comparison to the domestic ones. It is estimated that about 80 % of beef breed weaners are sold for finishing abroad.

It is peculiar for organic beef that the respective support has generated without doubts environmental and landscape values, while the "organic" specificity has failed to reach Czech consumers. It is in contrast to citizens' willingness to pay for grassland maintenance, especially if jointness is to exist between grasslands and pastoral beef cattle production (Prazan et al. 2006, Ratinger et al, 2004, Durand, Huylenbroeck 2003). One explanation rests in lack of knowledge that "organic" means first of all protection of environment, and thus in the poor communication between organic farmers and potential consumers. Another explanation relays on the non-exclusion problem of public goods which consumers are aware of (Ratinger et al. 2004).

[3] Note the dairy herd decline.
[4] Young bulls of about 9 months.

Table 2 Cost benefit analysis of beef production on grasslands (typical farm, 2012)

Item		Value		BC ratio
		CZK/ha	EUR/ha	
Cost	beef, hay (cash+depr.)	7 922	313.3	
Market earnings	*beef*	*5 989*	236.8	76%
Market earnings	*hay*	*857*	33.9	11%
Market earnings	**total**	**6 846**	**270.7**	**86%**
Support	SAPS	4 060	160.5	51%
	LFA Payment	4 139	163.7	52%
	AEM/organic	5 323	210.5	67%
	top up UAA	514	20.3	6%
	top up suckler cows	848	33.5	11%
	top up livestock unit (LU)	796	31.5	10%
	Other national	150	5.9	2%
Total support		**15 830**	**626.0**	**200%**
Social value	WTP	7483	296	94%
	WTA	15230	602	192%
Profit	market	-1 076	-43	
	total	14 754	583	

BC ratio – a benefit cost ratio

Source: own case study

The economics of the beef-grasslands production as well as a simple cost benefit analysis is illustrated on a case study conducted in this research. This farm extends on about 1500 hectares, has 420 suckler cows, the overall livestock density is 0.61 LU/ha. Market earnings cover just 86% of the costs. In contrast total support is twice higher than costs. It finally generates profit of €583 per hectare. Comparing to the average WTP and WTA estimates, the AE supports do not cover the societal ecological value of grasslands (see the discussion in Conclusions). This a case of a very successful farm; it is worth to stress the average economic results of beef cattle farms in the UZEI cost sample are a bit less impressive (see paragraph 8), nevertheless, still generating substantial profit. One third of the beef cattle production in the sample is tremendously unprofitable.

6. FARM MODEL

To address the above issues and to assess the (private) economic viability of grassland farms under various policy scenarios we developed a set of "uniform" farm level models[5]. Actually it is an extension of the currently used FARMA4 (Foltyn et al., 2007, Ratinger et al. 2011). The farm models are linear programming models with the option of a quadratic cost function in the objective function option (Positive Mathematical Programming approach, Howitt, 1995). The FARMA 4 model includes potentially 23 farm enterprises (of it 15 crop and

[5] Structurally identical

8 animal ones) in up to 3 intensification modes. The objective function is usually gross profit. The standard model is built for three production regions named by the dominant crop (Corn & Sugar Beet [CSB], Cereal [CER], Potato & Oat/Mountain [POM]). Two farm types are considered in the POM region: a mixed farm and a specialised pastoral beef farm]. The model applied in this paper does not consider SCB region, since there play grasslands really only a very marginal role and if they are present then for mainly environmental purposes. On the other hand, the POM region is split on Potato & Oat [POO] and Mountain [MOU] regions. There are two farm types considered for each of these three regions – mixed farms with about 50% of grasslands and specialised beef cattle farms with 90% of grasslands.

Maps in Figure 4 illustrate differences in grass yield among production regions (CER, POO, MOU). In order to capture location of grassland farms we used district instead of cadastres as it is in Figure 1and Figure 2.

Grasslands are divided into pastures and meadows. The grass from pastures can only be used for the adjacent beef production while from meadows hay can be sold too.

There are four main sources of data: i) LPIS (2011) - which provides distribution of grasslands on farms and distribution of farms by the share of grasslands, ii) grass yields and feeding quality of grass by soil quality (BPEJ, Voltr et al. 2012) and cadastre, iii) FADN providing production structure and economic data and finally iv) cost survey providing economic figures per enterprise (activity in model terms).

The mentioned cost survey includes only large farms of the average size of 1100 hectares. However, by analyzing grassland farms in LIPS we have learned that the average size of farms with more than 90% of grasslands is 450 hectares. Thu the current model refers to large farms only. In the future we will differentiate farms also by size (i.e. a set of medium size farms will be introduced).

7. SCENARIOS

The support to grasslands will necessarily change in the next program period (2014-2020). First of all grassland maintenance will be in principle ensured by "greening" and it can be further enforced if the respective management is defined in GAEC. Second, the current flat rate support to grasslands is defined as a compensation for reducing application of fertilisers on grasslands. Our (above mentioned) survey however indicated that there is no difference in the application of fertilisers between participating and non-participating farms, which in turn means that the base for the compensation vanishes. Thus it is likely that the AEP will be limited to high biodiversity values located mainly (but not exclusively) in the protected areas. Third, Stolbova, and Doucha (2011) showed that income figures (e.g. net value added per AWU) are substantially higher for grassland farms[6] in LFA than for farm in non-LFA. It is, therefore, likely that LFA payments will be revised and lowered for grasslands[7]. Another likely change

[6] Predominantly extensive beef cattle
[7] Currently LFA payments a restricted only to grasslands

will be the extension of eligibility to all agricultural land and "degressivity" of payments with the size of recipients.

An overall decrease of the total support per hectare can be expected; in many cases the cut will be substantial. The question is what will be the response of farmers: will a gradual decrease of suckler cows follow or in contrast will farmers intensify the use of grasslands in order to get additional revenue from the market? Is there a danger of grassland abandonment?

To get an insight in these issues we defined two scenarios: Baseline, AEP cut and LAF payment reductions. Baseline refers to the continuation of the current policy toward grasslands i.e. with LFA and AE payments at the current levels, both restricted to grasslands only. Farms however will receive DP at the rate defined in the legislative proposal for Pillar 1 (EC 2011a). Since the assumed farm size is 1000 hectares, the farms are not exposed to capping[8].

Scenario1 assumes a complete cut of AEP on all farms except those in mountain regions. However, in mountain regions AEP will drop to half. LFA payments are extended to all agricultural land and reduced (€25/ha in CER,€50/ha in POO, €100/ha in MOU).

Scenario 1 will be calculated in two modes. In the short term effect mode (S1s) the livestock density minimum limit is maintained. It might still be included in the conditions for LFA support; at the same time it refers to short term inflexibility to adjust the beef cattle herd. In the adjustment mode (S1a) the condition

8. RESULTS

Scenario 1 is assessed in two modes. In the short term effect mode (S1s) the livestock density minimum limit is maintained. It might still be included in the conditions for LFA support; at the same time it refers to short term inflexibility to adjust the beef cattle herd. In the adjustment mode (S1a) the minimum livestock density condition has been removed. In addition, we have recalculated S1s scenario for organic beef farms (S1bio).

Results are summarised in Table 3 and Figure 3. In Table 3 we present absolute values of grassland management in euros per hectare of grasslands[9]. Since we assume baseline as a continuation of the current policy we do not split direct payments to "greening" and basic income support as it is in the proposal of the Pillar 1 for 2014-2020 (EC 2011a). Direct payments include also coupled headage payments for cattle. Since we consider beef as well as dairy cattle on grasslands on mixed farms (50% of grasslands), coupled payments include both coupled payments; however the share of dairy farms on grasslands is rather small. The variation in grass yields is reflected in costs (of grass and of beef). According to the UZEI's cost survey, revenues differ slightly between the beef the productions in CER region[10] and in the other two regions. It is likely that there are better conditions for finishing some bulls in the CER region while from farms in the rest two regions only weaners are sold.

[8] Subtraction of the labour cost will cause that such farms will not exceed the threshold for progressive capping
[9] Showed for entirely grassland farms (90%).
[10] Still in LFA, mostly the specific ones.

Table 3 Simulation results – cost and revenue indicators

90% of grasslands		Baseline			S1s			S1a			S1bio		
Unit	€/ha	CER	POO	MOU	CER	POO	MOU	CER	POO	MOU	CER	POO	MOU
Cost	grass	126	165	134	126	165	134	83	94	83	126	165	134
	beef	275	248	248	275	248	248	144	132	127	330	297	297
Market earnings	beef, hay	106	95	95	106	95	95	142	126	118	138	123	123
Envi/lanscape support	DP - greening				83	83	83	83	83	83	83	83	83
	AEM/organic	114	143	191							80	80	80
Income	social value	-180	-175	-96	-212	-235	-205	-3	-18	-11	-155	-177	-146
Income support	DP -basic + coupled	272	272	272	189	189	189	189	189	189	189	189	189
	LFA payment	114	143	191	25	50	100	25	50	100	25	50	100
Income	profit	206	240	367	3	4	85	212	222	279	59	63	144

S1s – Short term effect scenario - minimum 0.2 LU per hectare

S1a – Adjustment scenario – no minimum livestock density requirement

S1bio – recalculated S1s for organic beef farms

Source> own calculations (FARMA 4 model)

Similarly, AE payments differ substantially among the selected three production regions according to the Czech FADN and these differences are projected also in the baseline (BSL). This differentiations vanishes if AE payment are replaced by the "green" direct payments (30% of DP) because this is a flat rate payment for all UAA. If costs are subtracted from the market and social-environmental remuneration of farmer's activity the resulting income (profit – at social value) is negative.

The income support constituted of basic direct payments and coupled payments, and LFA payments is sufficient not only for covering the "social" production losses, but as well for creating interesting profit (from a bit more than €3,000 to about €400,000 on an average cost survey farm[11]).

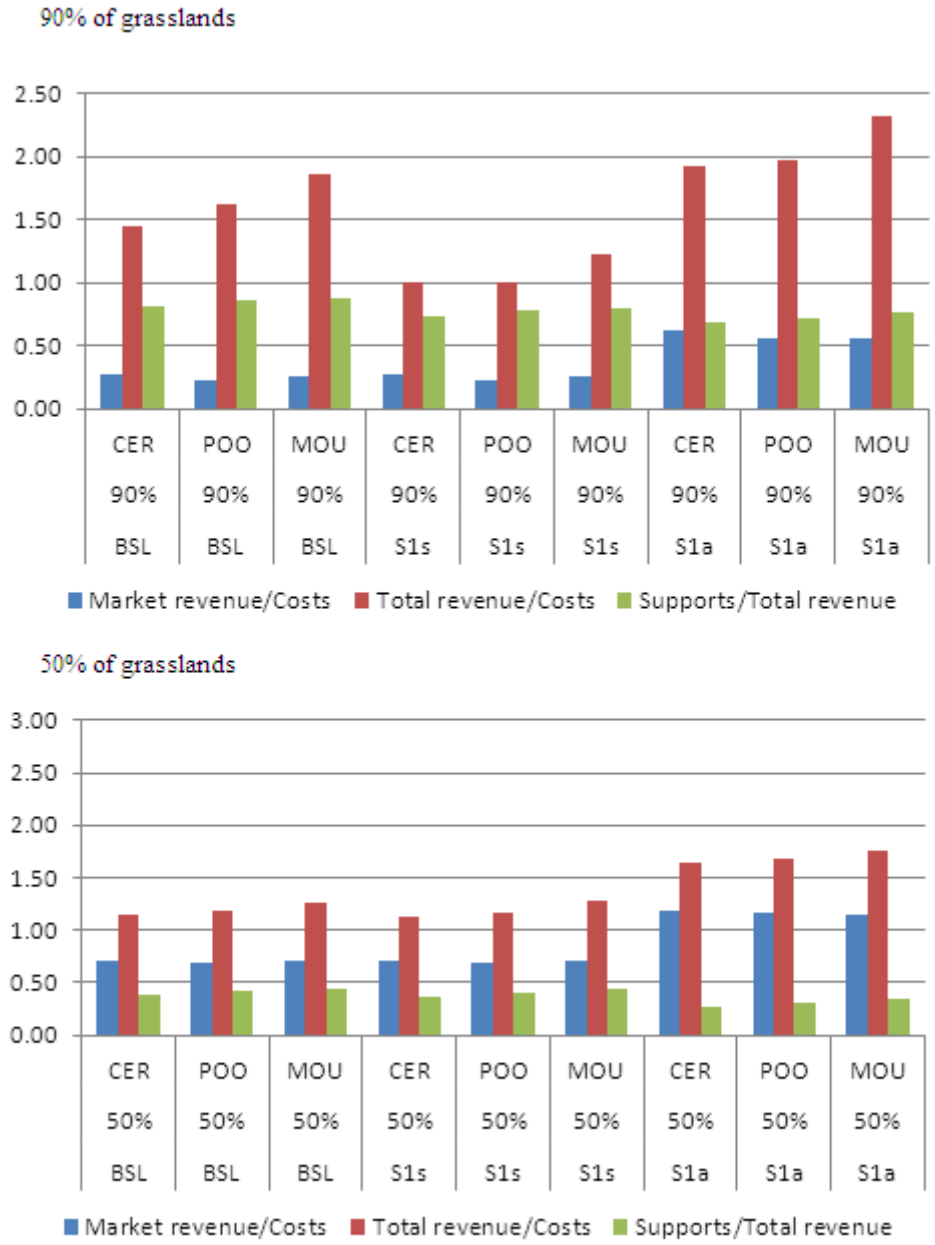
Comparing the scenarios, we can see that replacing AEM for grasslands by greening while maintain the minimum livestock density (0.2) will deepen social value/cost unbalance. If in addition LFA payments decline, the overall business income (profit) will be marginalised on beef cattle farms on grasslands in the CER and POO regions. If it is just a short term effect i.e. farms will be allowed to adjust livestock, then the suckler cows will go down (to half), farms will reduce fertilising grasslands and unfed grass will be sold as hay. This adjustment will improve the economics of grasslands substantially. Net income (profit) will approach the figures of the baseline.

It is likely that organic production support will be given only to farms of a certain intensity of beef production – hence, we assume that the minimum livestock density will be maintained as in the S1s scenario. If this support is roughly the same as at present (80 €/ha) then the economics of beef cattle – grassland production will improve significantly.

The relative performance indicators presented in Figure 3 refer to the all farm enterprises, not just only to beef-grassland production. The change of the policy will have severe impact on farms performance if their flexibility is limited. In this case, total revenue will just cover costs. However, relaxing the pressure on beef production will release part of the arable land for more profitable crop than fodder crop and thus result in higher revenue per farm (market revenue will more than double). It will improve farm profitability (revenue/cost ratio). The dependence on the public supports otherwise high (particularly on predominantly grassland farms) will slightly decline.

[11] 1100 hectares; the profit interval will be roughly of half values for the average grassland farm from LPIS.

Figure 3 Results of scenarios - performance indicators



Source: own calculations (the model FARMA 4)

9. CONCLUSIONS

In several places in the paper we have touched the issue of social value of grasslands: this value consists of both the market value of the output (paragraph 8) and the environmental (non-market) value of grasslands as biodiversity and landscape factors (paragraph 3). The market output includes first of all beef and partly hay. Concerning the former, we have already mentioned that the assumption of jointness between pastoral beef production and the provision

of the environmental values is embedded in the current definition of AEM supporting appropriate cultivation of grasslands. It is showed in Table 3 in the previous paragraph that costs of cultivating grasslands exceptionally by raising beef cattle are covered by market value and AE payments in neither scenario. However, we can assume that LFA payments are to compensate low productivity of land in areas with natural handicaps. Adding them to market earnings the relationship between "targeted" earnings and costs improves significantly (Table 4)

Table 4 Cost coverage by market and environmental policy earnings.

		Baseline			S1s			S1a		
		CER	POO	MOU	CER	POO	MOU	CER	POO	MOU
Market + LFA payments,+ coupled DP	€/ha	242	259	308	153	167	217	189	198	240
Compenastion of envi value	€/ha	114	143	191	83	83	83	83	83	83
Cost coverage	%	89%	98%	131%	59%	60%	78%	120%	124%	153%

Source: own calculations

The cost coverage is seriously dissatisfactory in the scenario S1s while scenario S1a indicates that there might be a space for improving market contribution if the level of joitness between beef production and grassland maintenance is reconsidered. Note, however, that our assumption of good market for hay is too strong. Also, the arable production can be in reality a bit less profitable that we assume (based on the current good prices for cereals and rape seed).

Another question is how AE supports match with environmental value of grasslands assessed by Czech citizens. It is demonstrated in Table 5. Here, we used the average WTP and WTA figures of Majerova, Wollmuthova (2011). Clearly, the targeted public support to grasslands is deeply below the WTP and WTA averages, close to the lower bound of the WTP estimate (€168) in the baseline and S1bio. The green part of DP is far from reflecting the citizens' valuation of grasslands.

Table 5 The societal environmental value of grasslands and the policy supports (€/ha)

		Baseline			S1s,a	S1bio
		CER	POO	MOU	All	All
Social value	WTP	296	296	296	296	296
	WTA	602	602	602	602	602
AE supports	DP-Greening				83	83
	AEM/organic	114	143	191		80
	Total	114	143	191	83	163

Source: own calculations

In contrast, the basic income support of DP provides sufficient funds to grasslands that they finally generate profit in all scenarios. This profit is substantial in most cases except for CER and POO regions in S1s scenario. There are two issues associated with it i) basic direct payment is fully decoupled, hence, hardly to be considered as a support to the maintenance of grasslands, while the cultivation of grasslands depends on it, and ii) all the supports together are a bit too generous (except the already mentioned two cases).

Another critical point is the size of farms; if farms were smaller, costs would be likely higher (at least labour can be used more efficiently on the large beef-grassland farms). In spite of the presence or not of the economy of scale, profits accumulated from direct payments on large farms will be substantial. Obviously, capping as originally proposed in the Commission's Communication (EC 2010) will be a relevant approach – but it seems effective capping will not be introduced. Member States might introduce degressivity by size of LFA payments, which might be effective for reducing excessive profits, however, it will be an illogical way, since the problem does not rest in the possibly inappropriate compensations of handicaps, but in the basic income support provided as a flat rate area payment.

While the model calculations show that the response of farmers will likely be lowering production intensity, the case studies we conducted in the framework of this research indicate opposite reaction. In the both cases, the interviewed farmers (medium - 600 hectares and large - 1800 hectares) indicated their intention to increase their suckler cow herd in order to compensate loss of some supports in the future programme period by higher market returns. It is worth to add that both farmers have already settled their marketing channels and get the price for beef substantially above the national average. The message of it is that we have to further improve the model that we are able to capture both ways of farmers' response to envisaged policy change.

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REFERENCES

ČSÚ, 2011. Czech statistical office. Agrocenzus 2010 – strukturální šetření v zemědělství a metody zemědělské výroby. Available In Czech only. http://www.czso.cz/csu/2011edicniplan.nsf/p/2126-11

Doucha, T., Foltyn, I, Humpal, J. (2012) *Profitability of dairy and suckler cow breeding on Czech farms*. Agricultural Economics (Czech), forthcoming.

Durand, G., Van Huylenbroeck, G. (2003): *Multifunctional agriculture: a new paradigm for European agriculture*. In Durand, G., Van Huylenbroeck (eds) Multifunctional Agriculture: a New Paradigm for European Agriculture and Rural Development. Ashgate, Aldershot, 2004. ISBN: 0-7546-3576-7, 256 pp

European Commission (EC) (2010) Communication from the Commission, 'The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future'. COM (2010) 0672

European Commission (EC) (2011a) *Regulation of the European Parliament and of the Council establishing rules for DP to farmers under support schemes within the framework of the CAP*. COM (2011) 625/3 12.10.2011: http://ec.europa.eu/agriculture/cap-post-2013/legal-proposals/index_en.htm

European Commission (EC) (2011b) *Regulation of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD)*. COM (2011) 627/3 12.10.2011: http://ec.europa.eu/agriculture/cap-post-2013/legal-proposals/index_en.htm

Foltýn, I., Zedníčková, I., Kopeček, P., Kubát, J.:(2007) *Mathematical Modelling of Sustainability in the Czech Agriculture*, the paper presented at the VI AIEA2 International Conference at the XLV SOBER Congress, Londrína, Paraná, Brazílie,, pp 20.

Guess, G. M., Farnham, P. G. (200) *Cases in Public Policy Analysis*. Gorgetown University Press, pp. 360

Howitt, RE (1995). Positive mathematical programming. American Journal of Agricultural Economics. 77. 329-342.

MoA (2012) Report on the state of Czech Agriculture in 2010 (in Czech only). Ministry of Agriculture, pp 176

Pražan, J. Ratinger, T. Křůmalová, V. (2005)*The evolution of nature conservation policy in the Czech Republic—challenges of Europeanisation in the White Carpathians Protected Landscape Area*. Land Use Policy, Volume 22, Issue 3, 235-243

Ratinger, T. Křůmalová, V., Pražan, J. (2004) Institutions and policies for Sustainable Land Management in the Czech Republic. In G. Van Huylenboeck, W. Verbeke, L Lauwers (eds.) Role of Institutions in Rural Policies and Agricultural Markets. Elsevier B.V.375-389

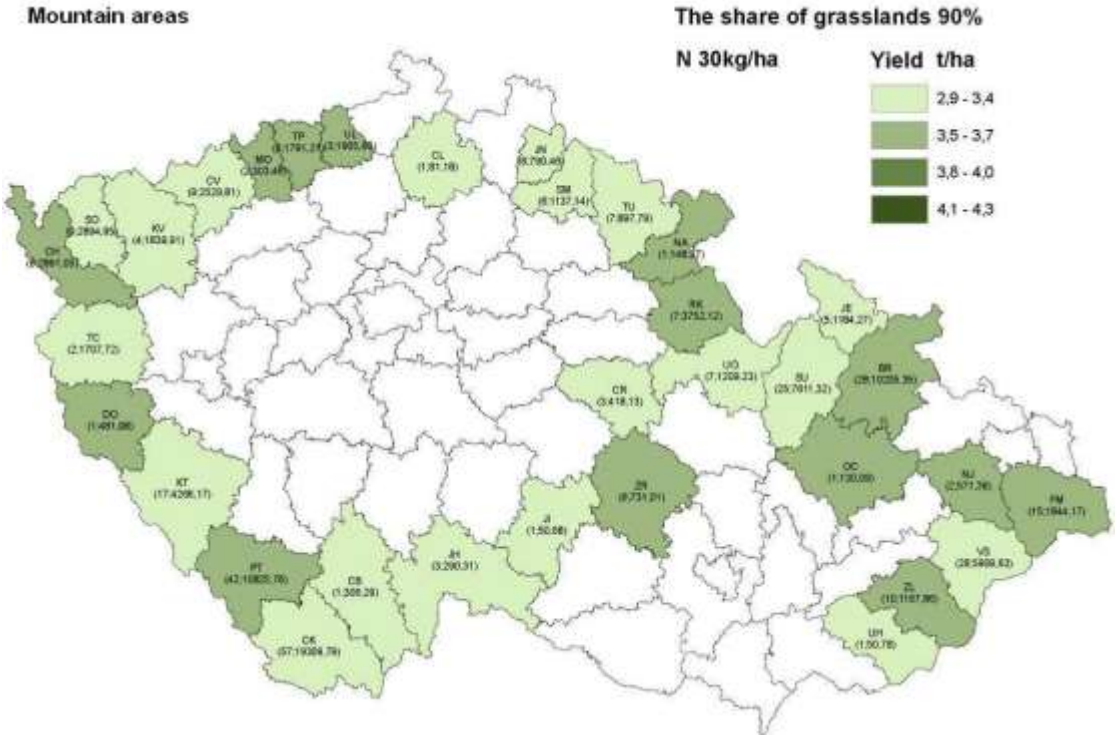
Ratinger, T. Folty, I, Humpal, J., Jelinek, L., Kristkova, Z, (2010) Podklady pro pozici MZe pro vyjednávání o finanční perspektivě EU na období 2014 – 2020 (An analysis for the position of the MA for the financial perspective negotiations. Only in Czech). Report on the Phase I. UZEI

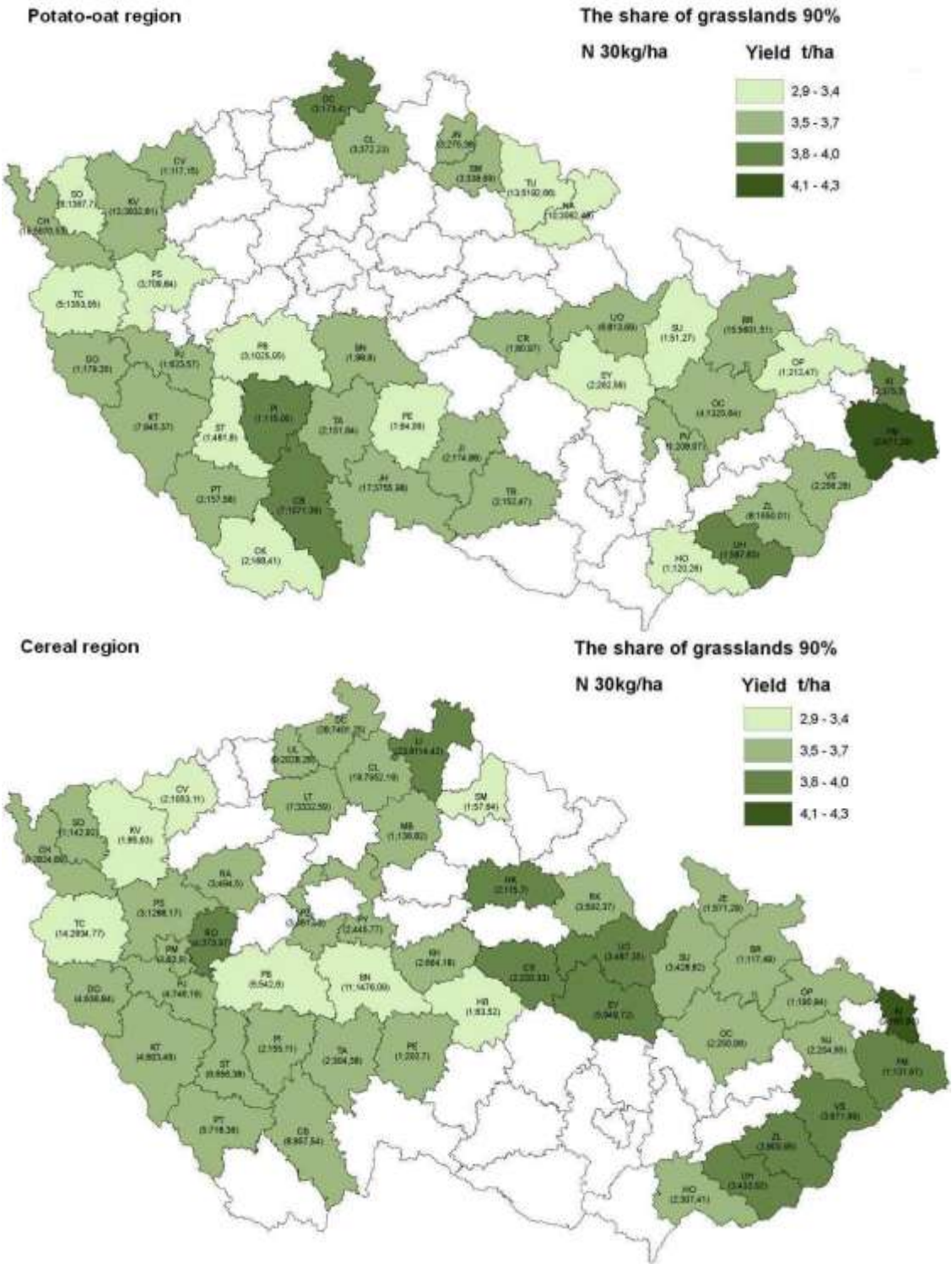
Voltr, V. a kol.: (2011) *Hodnocení půdy v podmínkách ochrany životního prostředí*, (Land value in the context of environmental protection) ÚZEI,monografie, výstup z projektu NAZV QH 722257, ISBN 978-80-86671-86-4

Wollmuthova, Majerova, J. (2011) An assessment of the value of agricultural landscape. The final report of the task 4.1. of the national project "Multifunctional Agriculture" MZE0002725101. Pp. 50

APPENDIX – MAPS

Figure 4 Average grass yield and number of farms in FADN





Source: own maps based on Voltr et al. 2012.