INFORMATION ON LULUCF ACTIONS IN THE CZECH REPUBLIC

Report under LULUCF Decision 529/2013/EU Article 10

Submission to the European Commission

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Ministry of the Environment
of the Czech Republic

Contents

Introduction

The information on LULUCF actions by the Czech Republic was prepared pursuant to the Article 10 of Decision No 529/2013/EU of the European Parliament and of the Council of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities. It also takes into account additional guidance provided by the European Commission.

The main sources of information compiled in this document are the National Inventory Report 2014, Sixth National Communication of the Czech Republic to the UNFCCC, national greenhouse gas projections, Submission of information on forest management reference levels by the Czech Republic and several sector specific studies.

The report has been prepared by the Ministry of the Environment of the Czech Republic in cooperation with experts from the Ministry of Agriculture and Institute for Forest Ecosystem Research (IFER).

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National Circumstances

Forests and Forestry

The Czech Republic is one of the countries with high forest coverage. The area of forests has been growing since the second half of the 20th century, mostly due to a long-term trend of afforestation of infertile cropland (in recent years the annual gain has been approximately 2 000 ha). Total area of forest land reached 2 662 thousand ha in 2012, which is approximately one-third of the Czech territory (33.8% of the total territory). This is slightly more than the average in Europe (32.2% in 2010).

In afforestation, there has been an effort to increase the share of broadleaved species at the expense of conifers. In 2012, more than 73.2% of forests were coniferous forests (76.5% in 2000) and 25.6% broadleaved (22.3% in 2000). Total wood supply in the Czech Republic has been growing and reached 686 million m^3 in 2012.

Trends in the area of forest land in 1920 – 2012 (thousand ha)

	1920	1930	1945	1950	1960	1970	1980	1990	2000	2005	2010	2011	2012
Area	2 369	2 354	2 420	2 479	2 574	2 606	2 623	2 629	2 637	2 647	2 657	2 660	2 662

Source: Ministry of Agriculture

Trends in the total standing stock of wood in forests in 1930 – 2012 (million m^3)

	1930	1950	1960	1970	1980	1990	1998	1999	2000	2005	2010	2011	2012
Standing stock	307	322	348	445	536	564	615	625	630	663	681	683	686

Source: Ministry of Agriculture

Trends in some basic characteristics of forest management in 1990 – 2012 (million m^3/year)

	1990	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**
Total harvesting	13.3	12.4	14.4	15.5	16.7	15.4	15.1
Salvage logging	9.8	7.9	3.3	4.5	6.1	3.8	3.2
Salvage logging in % from total harvesting	74%	64%	23%	29%	36%	25%	22%
Total increment	17.0	18.0	19.8	20.5	21.2	21.4	21.6
Ratio of increment and harvesting	78%	69%	73%	76%	79%	72%	70%

Source: Ministry of Agriculture, Forest Management Institute, Czech Statistical Office

With regard to the ownership, 59.8% of the forests are owned by the state, 16.8% by cities and municipalities, 19.3% by private persons, 2.9% by legal entities and 1.2% by other owners (2012 data). Lesy CR s.p. (Czech Forests, state enterprise), respectively Vojenske lesy s.p. (state enterprise) and National Park Administrations manage forests owned by the state. With regard to the function of forests, there are production forests (74.6%), protective forests (2.5%) and special-purpose forests (22.8%). Forests dominantly used for wood

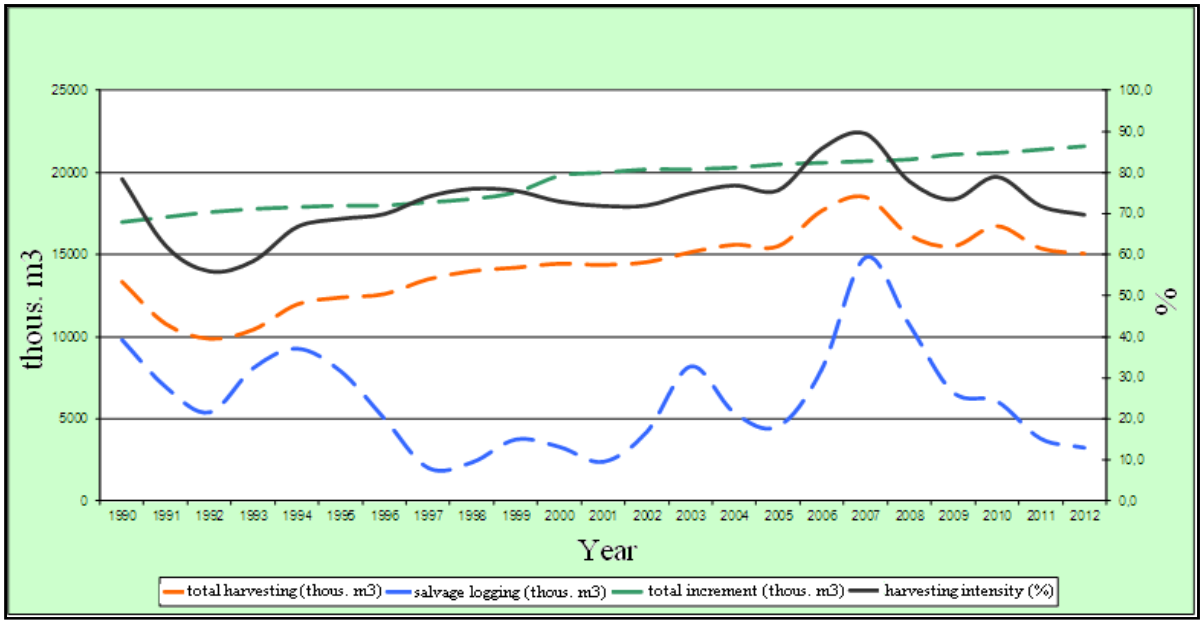
production are administered by the Ministry of Agriculture. Forests in national parks and their protective zones are administered by the Ministry of the Environment.

The share of the forestry sector in the creation of gross value added fluctuates between 0.5 and 0.8% in recent years (in normal prices).

In previous decades, forests have been severely damaged by industrial pollution. Despite dramatic decrease in pollutant emissions into the air (especially SO_2), forest health is improving only slowly. The persisting sensitivity of forest health is mainly due to long-term forest soil acidification and nutrient degradation, as well as intensive forest exploitation. Forests are also being affected by high concentrations of tropospheric ozone and weather extremes, such as wind-brakes and drought spells, which are usually accompanied by fungal and pest infestations.

The area of forest land of the Czech Republic has been steadily slightly growing. Between 2011 and 2012, this area grew by 2 thousand ha. The increase has been caused by afforestation of infertile cropland.

Comparison of total increment with harvesting [million m³]; Forest Management Institute



Broadleaved species have been expanding at the expense of conifers in terms of forest composition, which is becoming more mixed, with spruce and pine tree species relatively declining, being replaced by beech, oak, ash and maple tree species. This is a result of a long-term effort to achieve a more balanced and natural composition of the forests in the Czech Republic. There is also a specific financial state support focused on ensuring the necessary ratio of ameliorative and reinforcing woody species during forest restoration.

The Land Use, Land-Use Change and Forestry (LULUCF) sector closely relates to agriculture and forestry. The most important LULUCF land category in the Czech Republic in relation to greenhouse gas emission balance are the forest areas. Forestry in the Czech Republic is regulated by the Forest Act (Act No. 289/1995 Coll., on Forests, as amended), which forms the fundamental legislative instrument. While Forest Act does not directly

determine the specific targets for forest carbon stocks, its provisions indirectly regulate carbon stocks and reduction of greenhouse gas emissions in many respects.

Strong emphasis has been placed on issues related to carbon stocks and emissions from the forestry sector during the negotiation and elaboration of the National Forestry Programme II. This programme was approved by the Government Resolution No. 1221/2008 and should lead to a draft forestry bill, which would contain specific measures preventing climate change and promoting adaptation to climate change in the forestry sector. The National Forestry Programme contains “Key Action 6” – aiming to “Reduce impacts of anticipated global climate change and extreme meteorological events”, formulated in 12 specific measures. These measures are focusing on creating more resilient forest ecosystems by supporting diversified growth with the highest possible use of natural processes, diverse wood plant composition, natural capacity for restoration and variability of afforestation methods.

It may be anticipated that forest carbon sink will be decreasing in the coming years. The main reason is the unfavorable age structure of forests in the Czech Republic. The temporary decrease in sinks will also be due to the planned increase of broadleaved species representation. Nevertheless, this measure is a significant adaptation measure, which aims to ensure long-term stability of forest stands and also carbon accumulation over a long-term horizon. In the future, we also expect a more extensive use of biomass for energy purposes and larger volume of carbon accumulated in harvested wood products.

Area according to category IPCC [thousand ha]; NIR 2014

Territorial category	1990	2012
Forest Land	2 629.5	2 659.8
Grassland	878.2	1 035.0
Cropland	3 455.0	3 239.9
Wetlands	157.5	163.1
Settlements	658.9	681.3
Other	107.2	107.2

Agriculture

Agriculture has typical central European character with predominance of food production and high share of arable land (71.3%). Zonal character of agriculture is driven by altitude rather than latitude. Agricultural production is sufficient to cover domestic demand in terms of basic products. Crop production prevails over animal production. Yield converted to area is lower than in neighbouring countries. Contribution of agriculture to GDP is about average in the EU.

Cropland in the Czech Republic, same as in other EU Member States, suffers from real estate development, because the main urban centres in the Czech Republic are situated in the most productive agricultural areas. Despite the fact that, the Czech Republic remains one of the countries with the largest shares of crop land in total agricultural land area in the EU. The main crop is grain, especially wheat.

During the last fifteen years, there has been a marked drop in size of livestock, despite the fact, that livestock numbers increased in certain neighbouring countries. This is apparent in

international comparison, where livestock numbers are below average even within the framework of the EU. Animal production corresponds to livestock numbers, and within the EU the meat production is also below average. Milk production has been falling despite the increased milk yield per cow, which is not sufficient to compensate for falling numbers of cows.

From the total territory of the state (approximately 7.9 million ha) the agricultural / farming land covered 53.6% in 2011 (in 2003 it was 54.1%), which represents approximately 0.4 ha per inhabitant. Consumption of mineral fertilizer and calcic substances has been stagnating in recent years, along with decrease of livestock, where production fell along with consumption of manure.

Development of organic farming is a positive trend. The number of organic farms has been growing in the recent years. However, the economic crisis and also the termination of support within the framework of the Rural Development Programme for 2007 – 2013 caused that, number of the organic farms has been consolidating. Number of distributors and producers of organic food is also growing.

After the transformation of the agricultural sector in 1990, there has been a considerable decrease in the use of mineral fertiliser and calcic substances due to cost reductions. In 1994, the application of mineral fertiliser and calcic substances increased again, and since then, it has been fluctuating slightly. At present time, the fertiliser application in the Czech Republic in comparison with the EU average is, more often than not, lower.

The concept of sustainable and multifunctional agriculture in the Czech Republic takes into account the reduction of greenhouse gas emissions and possible needs for adaptation measures, along with other environmental and socio-economic considerations. These objectives can be achieved by the measures included in Common Agricultural Policy of the EU, as well as through national measures. New national measures to reduce greenhouse gas emissions are being prepared and introduced continuously.

The implemented agrarian policies and measures should increase CO_2 fixation in the agricultural land while at the same time maintaining appropriate level of agricultural production and its intensity. The policies and measures in agriculture leading to greenhouse gas mitigation are based on prudent application of fertilizers, cultivation of cover crops, development of organic farming, implementation of modern and innovative technologies, monitoring fermentation of crop residues, etc. Recent agrarian policy has declared the goal of reducing nitrogen leaching and run-off.

Important measures to reduce emissions of GHGs in agriculture are optimal timing of fertilization, the exact amount of fertilizer application to crop use and optimal (covered) storage of manure. In the very advanced form all of these principles are included in the so called precision agriculture.

Description of past trends of emissions and removals (Article 10.2 a)

Information on past trends of emissions and removals 1990-2012 is in line with the “National GHG Inventory Report of the Czech Republic 1990 – 2012” submitted under the United Nations Convention on Climate Change (UNFCCC) and the Kyoto Protocol. For additional information please refer to the submitted report.

LULUCF sector includes emissions and removals of GHGs from forest land, cropland, grassland, wetlands, settlements and other land. Since 1990 LULUCF has been a net sink in the Czech Republic. The most important key category is Forest Land (5.A), in particular Forest Land remaining Forest Land (5.A.1).

GHG estimates in Sector 5 (LULUCF) for the period 1990 – 2012; NIR 2014

Land use Category/ $GgCO_2eq.$	5 Total	A Forest Land	B Cropland	C Grassland	D Wettlands	E Settlements	F Other
1990	-3437	-4682	1209	-83	22	84	12
1991	-8875	-9085	390	-251	28	39	5
1992	-10597	-10704	192	-160	10	58	7
1993	-9145	-9402	228	-155	9	169	6
1994	-6888	-6955	204	-266	8	119	2
1995	-6940	-6957	215	-295	10	86	1
1996	-7369	-7205	219	-509	11	113	1
1997	-6449	-6445	207	-347	16	119	1
1998	-6776	-7058	336	-253	24	175	1
1999	-6920	-6983	174	-333	24	198	1
2000	-7280	-7238	178	-392	27	124	21
2001	-7632	-7555	162	-374	12	111	12
2002	-7357	-7285	141	-369	33	110	13
2003	-5437	-5435	151	-356	22	178	3
2004	-5922	-5883	134	-371	19	172	7
2005	-6424	-6367	139	-369	20	152	1
2006	-3223	-3116	131	-377	20	112	7
2007	-456	-328	126	-368	19	92	3
2008	-4437	-4349	165	-373	22	93	5
2009	-6528	-6403	116	-362	20	101	1
2010	-5183	-5104	136	-366	34	115	2
2011	-7012	-6956	152	-325	31	86	1
2012	-7252	-7255	181	-302	25	99	1

More detailed GHG estimates in Sector 5 (LULUCF) and its categories in 1990 (base year) and 2012; NIR 2014

Sector/category	Emissions 1990 Gg CO_2 eq.	Emissions 2012 Gg CO_2 eq.
5 Total LULUCF	-3 437	-7 252
5A Forest Land	-4 682	-7 255
5A1 Forest Land remaining Forest Land	-4 461	-6 916
5A2 Land converted to Forest Land	-221	-340
5B Cropland	1 209	181
5B1 Cropland remaining Cropland	1089	93
5B2 Land converted to Cropland	120	88
5C Grassland	-83	-302
5C1 Grassland remaining Grassland	58	5
5C2 Land converted to Grassland	-141	-306

Sector/category	Emissions 1990 Gg CO_2 eq.	Emissions 2012 Gg CO_2 eq.
5D Wetlands	22	25
5D1 Wetlands remaining Wetlands	(0)	(0)
5D2 Land converted to Wetlands	22	25
5E Settlements	84	99
5E1 Settlements remaining Settlements	(0)	(0)
5E2 Land converted to Settlements	84	99
5F Other Land	(0)	(0)
5G Other	12	0

The following table contains the estimates of the net emissions/removals for the activities afforestation, reforestation and deforestation under Article 3, Paragraph 3 of the Kyoto Protocol for the first commitment period. The estimate for forest management is also included since the Czech Republic has elected to account for this activity under Article 3, Paragraph 4 of the Kyoto Protocol for the first commitment period. Emissions from cropland management and grazing land management are not estimated. The systems to estimate emissions and removals from these activities need to be developed in line with the Decision 529/2013/EU.

Emissions and removals resulting from afforestation, reforestation deforestation, and forest management 2008-2012; NIR 2014

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	Net emissions/removals						Accounting Quantity
	2008	2009	2010	2011	2012	Total	
	(Gg CO_2 eq.)						
A. Article 3.3 activities							
A.1. Afforestation and Reforestation							-1 571.67
A.1.1. Units of land not harvested since the beginning of the commitment period	-261.56	-283.76	-309.68	-346,73	-369.94	-1 571.67	-1 571.67
A.1.2. Units of land harvested since the beginning of the commitment period							NO
Czech Republic	NO	NO	NO	NO	NO	NO	NO
A.2. Deforestation	156.17	165.95	202.04	160.24	169.81	854.21	854.21
B. Article 3.4 activities							
B.1. Forest Management	-4 081.06	-6 118.73	-4 799.38	-6 630.57	-6 911.29	-28 541.03	-5 866.67
3.3 offset							0.00
FM cap							-5 866.67
B.2. Cropland Management (if elected)	NA	NA	NA	NA	NA	NA	0.00
B.3. Grazing Land Management (if elected)	NA	NA	NA	NA	NA	NA	0.00
B.4. Revegetation (if elected)	NA	NA	NA	NA	NA	NA	0.00

Forest land (5A)

The Czech Republic is a country with a long forestry tradition. Practically all the forests can be considered to be temperate-zone managed forests under the IPCC definition of forest management (GPG Chapter 3, IPCC 2003). With respect to the definition thresholds of the Marrakesh Accords, Forest Land is defined as land with woody vegetation and with tree crown cover of at least 30 %, over an area exceeding 0.05 ha containing trees able to reach a minimum height of 2 m at maturity. This definition of forests excludes the areas of permanently unstocked cadastral forest land, such as forest roads, forest nurseries and land under power transmission lines. The permanently unstocked area of cadastral forest land has predominantly the attributes of Grassland, and therefore it was ascribed to that category. Hence, Forest Land in this emission inventory corresponds to the national definition of timberland (Czech Forestry Act 84/1996). In 2012, the stocked forest area (timberland) qualifying under the category of Forest Land in the emission inventory equalled 2 609 thousand ha, representing 98 % of the cadastral forest land in the Czech Republic. The permanently unstocked area represents 2 % of the forest land according to cadastral data and it was linked by this proportion to the area of Forest Land for the whole time series since 1969.

Forests (cadastral forest land) currently occupy 33.9 % of the area of the country. The tree species composition is dominated by conifers, which represent 73.2 % of the timberland area. The four most important tree species in the country are spruce, pine, beech and oak, which account for 51.4, 16.7, 7.7 and 7.0 % of the timberland area, respectively. Broadleaved tree species have been favored in new afforestation since 1990. The proportion of broadleaved tree species increased from 21 % in 1990 to almost 26 % in 2012. The total growing stock (merchantable wood volume) in forests in the country has increased during the reported period from 564 mil. m^3 in 1990 to 686 mil. m^3 (under bark) in 2012 (Ministry of Agriculture, 2013). The average growing stock has increased steadily for all tree species groups since 1990 in the Czech Republic.

Cropland (5B)

In the Czech Republic, Cropland is predominantly represented by arable land (93 % of the category in 2012), while the remaining area includes hop-fields, vineyards, gardens and orchards. Cropland is spatially the largest land-use category in the country. Simultaneously, the area of Cropland has constantly decreased since the 1970s, with a particularly strong decreasing trend since 1990. While, in 1990, Cropland represented approx. 44 % of the total area of the country, this share decreased to 41 % in 2012. It can be expected that this trend will continue. The conversion of arable land to grassland is also actively promoted by state subsidies. In addition, there is a growing demand for land for infrastructure and settlements. The current estimate of probable excess lands qualifying for conversion to other land-use in the near future is about 600 000 ha. Conversion to grassland concerns mainly the lands of less productive regions of alpine and sub-alpine regions.

Grassland (5C)

Through its spatial share of about 14 % in 2012, the category of Grassland ranks third among land-use categories in the Czech Republic. Its area has been growing since 1990, specifically in early 1990s. This land is mostly used as pastures for cattle and meadows for

growing feed. Additionally, the fraction of permanently unstocked cadastral Forest Land is also included under Grassland. This is because it predominantly has the attributes of Grassland (such as land under power transmission lines). The importance of Grassland will probably increase in this country, both for its production role and for preserving biodiversity in the landscape. According to the national agricultural programs, the representation of Grassland should further increase to about 18 % of the area of the country. The dominant share should be converted from Cropland, the share of which is still considered excessive. After implementation of subsidies in the 1990s, the area of Grassland has increased by over 17 % (in 2012) since 1990.

Wetlands (5D)

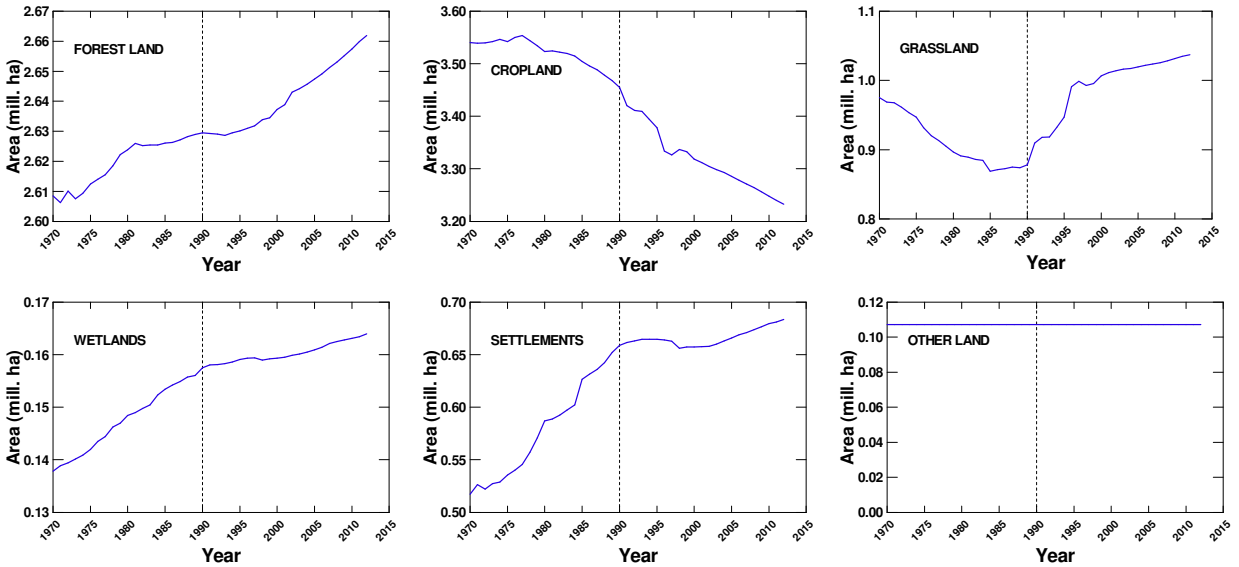
Category *5D Wetlands* as classified in the emission inventory includes riverbeds, and water reservoirs such as lakes and ponds, wetlands and swamps. It should be noted that there are about 11 wetlands identified as Ramsar sites in the Czech Republic. However, these areas are commonly located in several IPCC land-use categories and are not directly comparable with the actual content of the 5D emission category.

The area of *5D Wetlands* currently covers 2.1 % of the total territory. It has been growing steadily since 1990 with even a stronger trend since 1970. It can be expected that this trend would continue and that the area of Wetlands would increase further. This is mainly due to programs aimed at increasing the water retention capacity of the landscape.

Settlements (5E) and Other Land (5F)

Category *5E Settlements* is defined by IPCC (2003) as all developed land, including transportation infrastructure and human settlements. The category of Settlements represented about 8.7 % of the area of the country in 2012. The area of this category has increased since 1990 and especially during the most recent years. Category *5F Other Land* represents 1.0 % of the territory of the Czech Republic and it is considered to be constant, not involving any land-use conversions.

Trends in areas of the six major land-use categories in the Czech Republic between 1970 and 2012 (based on information from the Czech Office for Surveying, Mapping and Cadastre)



For further information the first estimates for contribution of the harvested wood products pool to the emissions balance are provided in the following table. The average accumulation of CO_2 in harvested wood products for the period 1990 – 2013 was estimated at – 1140 $GgCO_2$/year.

HWP contribution to emissions/removals in the period 1990 – 2013 calculated using first order decay function

Inventory Year	HWP Contribution to AFOLU emissions/ removals		
	First order decay		
	(Gg CO2)		
	Annual harvest	Annual CO2 release	Total contribution
1990	-11 811	10 098	-1 713
1991	-9 933	9 592	-340
1992	-9 457	10 216	759
1993	-9 699	9 412	-286
1994	-11 138	10 713	-425
1995	-11 525	10 691	-834
1996	-11 744	10 972	-772
1997	-12 574	11 733	-841
1998	-13 040	12 372	-668
1999	-13 238	12 434	-803
2000	-13 459	12 182	-1 278
2001	-13 397	12 186	-1 211
2002	-13 553	12 445	-1 108
2003	-14 111	12 616	-1 495
2004	-14 541	12 981	-1 560
2005	-14 456	13 010	-1 446
2006	-16 476	14 046	-2 431
2007	-17 250	14 313	-2 937
2008	-15 087	13 030	-2 057
2009	-14 448	13 382	-1 066
2010	-15 598	13 951	-1 648
2011	-14 336	13 350	-985
2012	-14 037	13 328	-709
2013	-14 289	12 787	-1 502

Source: IFER

Projections for emissions and removals from the LULUCF sector for the respective accounting period (Article 10.2 b)

The latest national GHG emission projection to be submitted to the European Commission in March 2015 under the Monitoring Mechanism Regulation is used for this report. It includes the estimates for “with measures” scenario (WEM) and “with additional measures” scenario (WAM) to 2030.

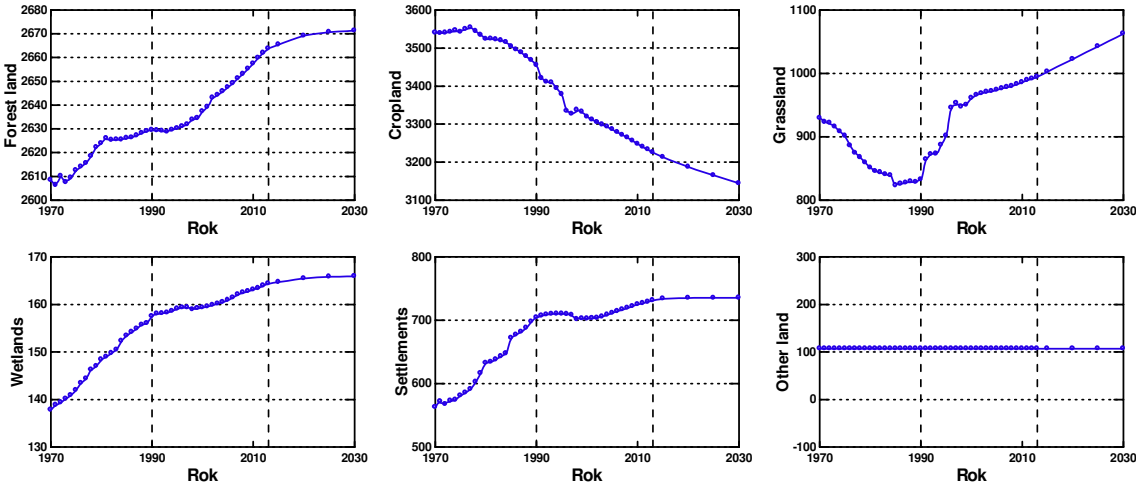
The projections are based on the observed trends and anticipation of gradually less intensive land use changes until 2030. The historical and projected land use areas are shown below. No dramatic changes are foreseen. There is a slight increase in forest, grassland and wetland land use categories while the area of cropland has been decreasing. That particular change in cropland land use category is in both relative and absolute numbers the most significant shift in the expected land use. In general, the only assumption implied by the land use change is that the rate of the observed changes in land use would tend to decrease for the projected period until year 2030.

Land use areas (all in kha): reported until 2012, projected until 2030

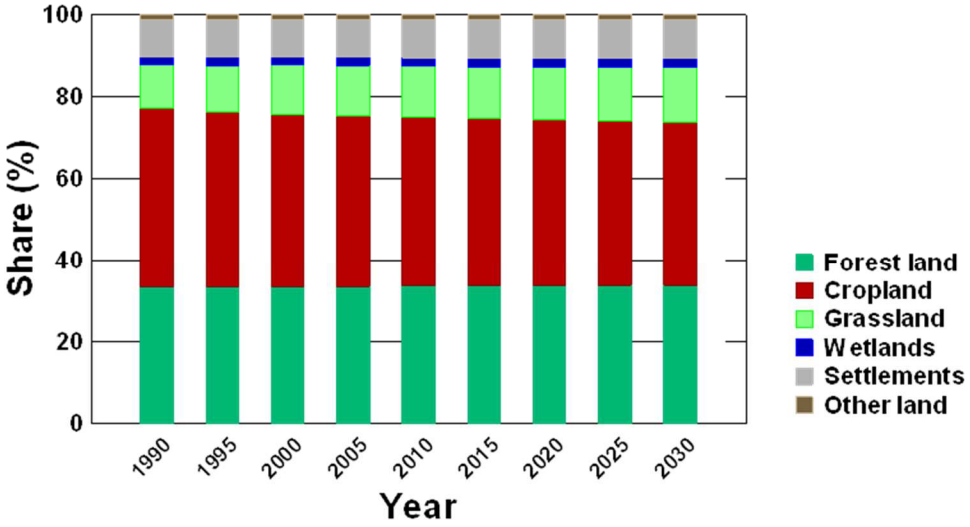
			Year									
Land use category	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2015**	**2020**	**2025**	**2030**
Forest Land	2647	2649	2651	2653	2655	2657	2660	2662	2665	2669	2671	2671
Cropland	974	976	978	980	983	986	989	992	1002	1022	1043	1063
Grassland	3286	3278	3271	3264	3256	3248	3240	3233	3213	3187	3165	3144
Wetlands	161	161	162	163	163	163	163	164	165	166	166	166
Settlements	712	714	717	720	722	725	727	729	734	735	735	736
Other Land	107	107	107	107	107	107	107	107	107	107	107	107

Source: NIR 2014, IFER

Actual areas of the major IPCC land use categories in the Czech Republic for the period 1970 to 2012 and the projected trends shown for the period until 2030



Share of areas for the six IPCC land use categories in 5-year intervals since 1990 to 2030, using the actual data until 2012 (until year 2010 in graph) and projections until 2030.



Following the setup of land use areas, the projection of emission estimates was prepared. The specific attention is given to forest land, which always represents one of the key emission categories in the Czech emission inventory. For this reason, the projections related to forestry are elaborated on the basis of scenario modelling using EFISCEN – the European Forest Information Scenario Model. The projections of greenhouse gas emissions related to

other land use categories besides Forest Land are based on simple correlations of estimated emissions for the reference year linked exclusively to the corresponding land areas for the predicted years.

The EFISCEN projections of greenhouse gas balance of Forest Land are based on the study performed within the project CzechForScen (Contribution of forestry to the emission balance of the Czech Republic and model prediction of forest management scenarios in the conditions of the Czech Republic), funded by the Czech Ministry of Education, Youth and Sports[1]. The calibration data used were obtained from the database of forest management plans administered by the Forest Management Institute, Brandys n. L. They corresponded to the state of the Czech forests as of 2010. The model EFISCEN, ver. 3.3[2] was applied on matrices on the level of 27 specific management units, 17 age classes and aggregation of five major tree species used in the Czech Forestry. The model predictions were constrained by the actual recommendations of the Czech Forestry Act as for the regeneration period, thinning and felling that were accordingly implemented on the level of individual management groups. The felling level request was adopted in the model identically across model scenarios. It was constructed as an average felling volume of the last known 5-year period (2009 to 2013), including the share of so called unregistered felling volumes, which relate to the harvest loss and accidental (sanitary/unplanned) felling in individual years. This way constructed total felling (thinning and final cut) reached 17.29 mil m^3 of merchantable wood volume annually. This includes 15.60 mil. m^3 harvested volume as reported by the official statistics, while the rest represents the unregistered harvest loss and losses reported by the Czech Statistical Office. This is consistent with the felling volumes as used in the emission inventory of the Czech Republic.

Definition of WEM and WAM scenarios in LULUCF projection

The WEM (With Existing Measures) scenario includes the development of land areas of individual land use categories as shown above. That development of land areas and land use changes drives the emissions of the reference year (2012) in response to the projected are change for the individual land use categories with exception of CO_2 emissions from Forest Land. For Forest Land, the EFISCEN model scenario is used that includes the currently implemented forest management recommendations of the Czech Forestry Act and actual species composition as of the reference year. The felling request remains stable and as of today (17.29 mil. m^3/year, incl. felling residues and loss) for the entire projection period.

The WAM (With Additional Measures) scenario is similar to WEM. It differs in the applied EFISCEN model scenario for Forest Land and CO_2 emissions. Specifically, it includes the proposed change of dominantly spruce even-aged forests stand to more diverse stands with higher share of broadleaved tree species such as beech and oak. The proposed species change is driven by the actual management groups and by altitude of their locations. This is

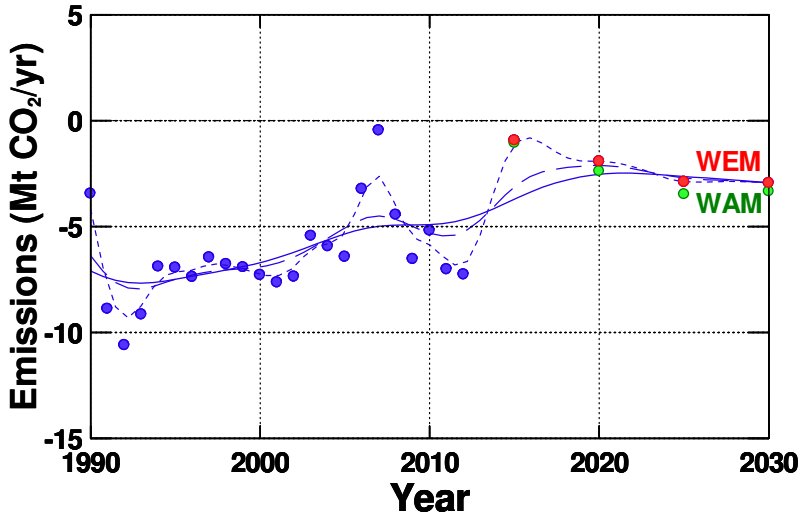
[1] Cienciala E. 2012. Model prediction of the effects of key forest adaptation measures in the Czech forestry on growing stock development and carbon balance. Project report to the Czech Ministry of Education, Youth and Sports (CzechForScen, OC10003), 26 pp.

[2] Schelhaas M.-J., 2007. Model documentation for the European Forest Information Scenario model (EFISCEN 3.1.3). Alterra-rapport 1559, EFI Technical Report 26, pp. 118.

the essence of the recommendations of the currently elaborated National Forest Program II, Key Action 6.

The historical data and projections using the WEM and WAM scenarios are shown below. It can be observed that for the nearest decades, the LULUCF sector remains to act as a sink of emissions under the current harvest demand remain for both WEM and WAM scenario. The difference between the WEM and WAM scenarios is insignificant in relation to both the overall trend and annual fluctuations of emissions in this sector. For the period predicted period until 2030, the emissions under the WAM scenario tend to be somewhat lower as compared to WEM. Although the net effect of WAM scenario is only 5 %, it should be noted that there are additional benefits associated with WAM. Specifically, the WAM scenario should result in more resilient and stable forest stands, which is essential for long-term sustainability of forest production and wide spectrum of services that forests provide.

Historic and projected (scenarios WEM and WAM) emissions of GHG for the LULUCF sector. The historic data (blue) and the WEM scenarios are accompanied by a least square smooth lines using different tension values that determine the local flex.



Historic and projected emissions of GHG for the LULUCF sector [Mt CO_2 eq.]

Scenario	1990	2012	2015	2020	2025	2030	2012- 2030
Historic data and WEM	-3.44	-7.25	-0,92	-1.92	-2.89	-2.94	59.4 %
Historic data and WAM	-3.44	-7.25	-1.05	-2.38	-3.47	-3.34	54.0 %

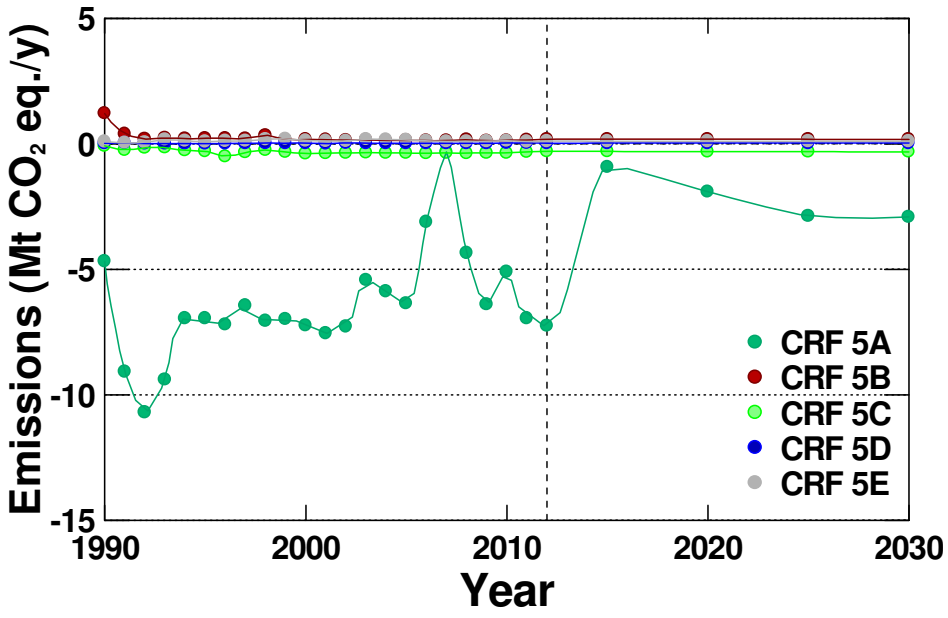
Breakdown of historic and projected emissions of GHG by gases in LULUCF for historic data and WEM and WAM scenario

Gas [Mt CO_2eq]	1990	2012	2015	2020	2025	2030	2012- 2030
WEM scenario							
CO_2	-3.555	-7.323	-1.002	-1.995	-2.962	-3.013	58.9 %
CH_4	0.096	0.058	0.058	0.059	0.059	0.059	0.4 %
N_2O	0.021	0.012	0.012	0.012	0.012	0.012	-1,3 %
Total (Mt CO_2 eq.)	-3.437	-7.252	-0,921	-1.924	-2.891	-2.942	59.4 %
WAM scenario							
CO_2	-3.555	-7.323	-1.118	-2.453	-3.545	-3.406	53,5%
CH_4	0.096	0.058	0.059	0.059	0.059	0.059	0,4%
N_2O	0.021	0.012	0.012	0.012	0.012	0.012	-1,3%
Total (Mt CO_2 eq.)	-3.437	-7.252	-1.048	-2.382	-3.474	-3.335	54,0%

It can be seen that the sink of CO_2 observed in LULUCF for the previous decades to a large extent diminishes. In relation to the base year of 2012, the sink of emissions would decrease by about 59 and 54 % in 2030 of that observed in 2012 for the WEM and WAM scenarios, respectively.

The breakdown of historical and projected (WEM scenario) emissions by individual land use categories is shown below.

Breakdown of historic and projected (WEM scenario) emissions of GHG by land categories within LULUCF, namely Forest Land (CRF 5A), Cropland (CRF 5B), Grassland (CRF 5C), Wetlands (CRF 5D) and Settlements (CRF 5E)



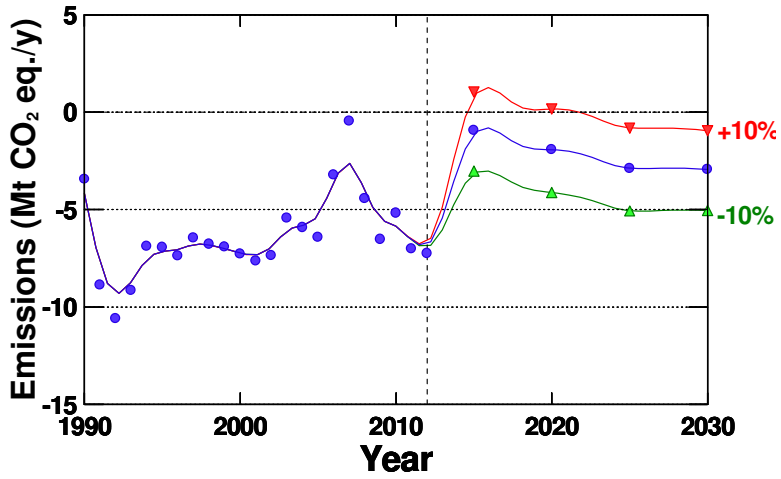
Breakdown of historic and projected emissions of GHG by the major sub-categories of the LULUCF sector for WEM and WAM scenario

Gas [Mt CO_2eq]	1990	2012	2015	2020	2025	2030	2012- 2030
WEM scenario							
5A Forest Land	-4.68	-7.26	-0.93	-1.92	-2.88	-2.92	59.8 %
5B Cropland	1.21	0.18	0.18	0.18	0.18	0.18	-2.7 %
5C Grassland	-0.08	-0.30	-0.31	-0.31	-0.32	-0.32	-7.2%
5D Wetlands	0.02	0.02	0.02	0.02	0.02	0.02	1.2%
5E Settlements	0.08	0.10	0.10	0.10	0.10	0.10	0.9%
5F Other land	NO	0.0	0.0	0.0	0.0	0.0	NA
5G Other	0.01	0.0	0.0	0.0	0.0	0.0	0.4%
WAM scenario							
5A Forest Land	-4.68	-7.26	-1.05	-2.37	-3.46	-3.31	54.6 %
5B Cropland	1. 21	0.18	0.18	0.18	0.18	0.18	-2.7 %
5C Grassland	-0.08	-0.30	-0.31	-0.31	-0.32	-0.32	-7.2%
5D Wetlands	0.02	0.02	0.02	0.02	0.02	0.02	1.2%
5E Settlements	0.08	0.10	0.10	0.10	0.10	0.10	0.9%
5F Other land	NO	0.0	0.0	0.0	0.0	0.0	NA
5G Other	0.01	0.0	0.01	0.01	0.01	0.01	0.4%

Sensitivity analysis

The key category of the Czech emission inventory is biomass carbon stock change in the emission sub-category 5.A.1 Land remaining Forest Land. This basically represents the forest management and its effect on growing stock volume. Here, the loss is determined by harvest demand including thinning and final felling. This is to be offset by annual woody increment. Therefore, harvest regime is the most prominent factor affecting carbon balance in the sector. Its role is demonstrated on the sensitivity analysis using smaller or larger overall harvest demand by 10 % with respect to the selected baseline (17.29 mil. m^3 annually) using the EFISCEN model. The outcome for the WEM scenario is shown below. It is apparent that a relatively small change in harvest demand would indeed have significant effect on emissions from the LULUCF sector. A smaller harvest demand would result in continuous carbon sink in forestry, while a larger felling would increase the change of changing the LULUCF sector from sink into a source category. It should also be noted that harvest demand is a more powerful short-term factor affecting emissions as compared to the management measures that distinguish WEM and WAM scenarios.

Sensitivity analysis using variable harvest demand and its effect on emissions in LULUCF under WEM scenario



Information on potential to reduce emissions, appropriate measures, existing and planned policies (Article 10.2 c-f)

Identification of appropriate measures in Agriculture

Due to the major significance of land / soil, its sustainable use (for instance, by protecting against erosion and degradation, or by improving its retention capacity and maintaining fertility), remains the crucial aspect of both climate change adaptation and mitigation. Potential solutions should be based on the following principles of sustainable farming:

- Suitable spatial arrangement of agricultural land,
- Soil-protecting and anti-erosion measures,
- Improvement of soil structure,

- Increasing the proportion of organic matter in the soil.

All these measures are very complex in their nature and linked to a number of factors. One factor is the relationship of owners to the land, which predetermines the possibilities that the above measures are actually implemented.

Agricultural ecosystems have the potential to mitigate climate change especially in terms of accumulating carbon in soil and reducing greenhouse gas emissions released within the sector, especially N_2O released from the soil and CH_4 generated by livestock. In this respect, the primary significance should be placed on increased content of organic carbon in soil, use of soil protecting technology or sustainable management of grasslands. Agriculture is the actual or potential source or raw materials for energy use. This involves energy plants or short rotation coppice cultivated on farming land, biologically degradable waste and secondary products. Their use reduces consumption of fossil fuels as well as limits releases of CH_4 from non-decomposed biomass.

Considering the diversity of agricultural measures, these may be classified in the following groups.

Land-use planning

Land-use planning creates conditions for rational management by property owners. Properties are thus classified in terms of space and function and provision is made for access to them. An integral part of all land-use planning also consists in a plan for joint facilities, encompassing, amongst other things, water management and anti-erosion measures (to protect the land fund and improve the water regime in the landscape) and measures to protect and create the environment and measures to increase the ecological stability of the territory (TSES and other green areas). Thus, land-use planning substantially reduces the impacts of extreme meteorological situations, prevents erosion of the soil and helps prevent floods.

Land-use planning measures are **already underway**. Estimates of the necessary and planned costs amount to 550 million CZK annually.

Agro-environmental measures

These measures were proposed in accordance with Council Regulation (EC) No. 1257/1999 and Commission Regulation (EC) No 817/2004, as well as Government Regulation No. 242/2004 Coll., on performance of agro-environmental measures, as amended.

The new programming period (2014 – 2020) of the Rural Development Programme will implement agro-environmental-climatic activities. The planned measures aim to maintain the existing high-quality ecosystems in order to strengthen the higher carbon (C) sequestration potential, reduce risk of nitrogen-related (N) emission impact in connection with more extensive farming and their appropriate adjustment will contribute to both climate change adaptation and mitigation by:

- Suitable treatment of grassland in wetland locations which have considerably higher potential to fix C and N;
- Maintenance of stabile ecosystems in areas suffering from deteriorating moisture conditions which minimises negative impact of wind erosion and threatened increased C and N loss;
- Sustaining increased C sequestration and N retention at waterlogged locations;

- Management of steppe locations minimises negative impacts of certain specific climate effects;
- Appropriate management on organic soil prevents increased greenhouse gas emissions;
- General management approaches supporting development of specific ecosystems with high adaptation potential to specific effects in their environment;
- Maintenance of existing high-quality ecosystems leading to maintenance or strengthening of increased sequestration potential;
- Reducing nitrogen emissions consequences;
- Maintenance of strengthening of N retention capacity by implementing of appropriate soil management practices, respectively transition to cultures with higher potential;
- Strengthening of anti-erosion measures with high sequestering effect especially in vulnerable locations, land areas endangered by erosion and in protective zones around water sources;
- Supporting sequestering potential of arable land temporarily influenced by water logging.

Measures created for the purposes of reducing negative effect of agricultural production on the environment **are already in effect** and at present time, majority of these measures are also adopted as a part of climate change-driven adaptation measures. Additional planned measures are a part of the framework of the Rural Development Program 2014-2020. The necessary and actual costs cannot be defined at present time.

Agro-environmental measures work in synergy with measures implemented under the Operational Programme Environment (OPE) 2014-2020 in the area concerned with management of valuable biotopes.

Afforestation and grass planting

Changing arable land to forest with good species composition or to permanent grassland operates as a measure combating wind and (in case of forests, partially) water erosion and reduces soil moisture loss. This measure also has a mitigation effect as forests and grassland accumulate more carbon than arable land and even non-aerated soil reduces oxidation processes leading to nitrous oxide and carbon dioxide emissions. Similar significance should be placed upon groves, balks and free standing trees.

The Rural Development Program will continue in the new programming period with afforestation and grass planting measures within the framework of agro-environmental and climatic activities.

These **measures are already in the process of implementation**. Planned measures will be implemented in 2014 – 2020. The necessary or planned costs cannot be defined at present time.

Organic farming

Principles applied in organic farming create prerequisites for achieving higher average carbon content and humus in soil, better treatment of organisms living in soil etc. They also support biodiversity of organism cultures as well as organisms that are directly or indirectly linked to farming land, which reduces the speed of genetic erosion. Organic farming may contribute to adaptation of agriculture to climate change by maintaining genetic sources of

indigenous species and plants, maintaining traditional knowledge, methods and pest control processes, methods limiting water consumption and soil erosion or methods of biological protection of plants (which is the preferred method of protection due to ban on chemical protection and GMO use).

The main measure supporting development of organic farming is stable support and activities with emphasis on non-farming functionality with adaptation effects.

This is a **continuously implemented** measure. In near future the organic farming should be implemented within the framework of an independent area of intervention within the programming period 2014-2020.

Research, cultivation and biotechnology in farming

Research focuses especially on cultivation of agricultural crops and on selection of suitable species and plants that are resistant to climate change and on cultivation of new and revitalization of original species and cultivars of arable crops and livestock that are aimed at producing good yield while being pest-resistant and coping well with drought, heat waves, high air temperatures, soil erosion etc.

The Czech Republic is involved in two European projects operated under Food security, Agriculture and Climate Change (FACCE) focusing on simulation and adaptation of agricultural systems. At national level, there are numerous partial research activities involving individual plants including their cultivation with respect to their increased resilience, i.e. increased ability to cope with new climate change effects and pests. Research projects focused on the mitigation and adaptation measures in the agriculture are supported by National Academy for Agricultural Research (NAZV) programmes.

These are **measures already under way** requiring continuing support. The Ministry of Agriculture, acting as one of support providers, estimates that support of these measures will amount to 10-15% of the total cost of agricultural research.

Measures combating agricultural drought

Keeping in mind the anticipated more frequent occurrences of agricultural dry periods it will be necessary to also support measures contributing to increased water retention capacity of the landscape and optimisation of irrigation systems as well as minimizing negative effects of drainage systems on accelerated runoff of water from the land. These measures relate to application of technologies and research results contributing to reduced water consumption and reduced losses of soil moisture. Irrigation systems also depend on continuous availability or irrigation water.

Specifically, these measures include construction and upgrades of irrigation systems which use irrigation water more efficiently and make crop production possible even during linger periods of drought. Irrigation systems should only subsidize moisture deficits preventing damage to soil structure and preventing other negative effects on production. Technologies and methods reducing the so-called non-productive evaporation and promoting more efficient use of soil moisture by plants represents also an important measure.

Measures are **already partially underway.**

Ensuring soil stability against erosion

Water erosion in the Czech Republic threatens almost 50% of land. Wind erosion threatens approximately 14% of the agricultural land in the most productive area of the Czech Republic.

Grass planting applied to arable land or creation of grassy strips on sloping parcels constitute some of the anti-erosion measures implemented during the monitored period; other measures include plough-free soil processing, planting methods protecting the soil, implementation of protective elements and zones and planting of anti-erosion barriers.

Wind erosion effects will gradually grow in importance, especially in warm and dry areas of Southern Moravia. The proposed anti-erosion elements and their individual parts will need to be corrected in this respect. Any proposal involving long-term high-cost anti-erosion measures (terraces, wind barriers, anti-erosion reservoirs etc.) must take into consideration potential climate change effects.

Measures are already being partially implemented as a part of general agriculture management. Additional anti-erosion measures will be implemented during the new programming period 2014-2020 (Rural Development Programme). The required and actually planned costs cannot be defined at this stage.

Diversification of agriculture

Systems, where an agricultural enterprise has more revenue sources (from other than just agricultural production) reduces risks arising in connection with agricultural production alone, especially when these risks are exacerbated by climate change.

The Rural Development Programme and other activities at national level provide support to production and processing of biomass used outside food processing industry as well as agro-tourism and other services. Use of biomass as renewable energy source must observe sustainability principles without exacting more negative influence on the environment or food prices. Impact on the environment is being continuously assessed (in terms of soil erosion, biodiversity, effect on farms / enterprises, energy security, consumption of water etc.).

These measures have already been implemented or are either already **underway**.

Good Agricultural and Environmental Conditions (GAECs)

GAEC-compatible farming activities have favourable influence on the content of organic substances in the soil, protection of soil structure, help in protecting various landscape features and permanent grasslands; they also partially limit spreading of invasive plant species etc.

Compliance with these measures, such as use of soil protecting technology in cultivating crops, bans on erosion hazardous plants and compliance with post-harvest soil cover in location that are prone to erosion, is being rigorously monitored.

These measures are presently **being implemented**.

Existing policies implementing the measures in Agriculture

Common Agricultural Policy (CAP)

The EU Common Agricultural Policy (CAP) has a significant relationship to the extent, orientation and profitability of agriculture. The CAP in the EU is based on three principles – a

common market for agricultural products based on common prices, preferences for agricultural production in the EU countries against external competition and financial solidarity - financing from common funds to which everyone pays contributions. The implementation of the CAP can affect the trend in GHG emissions from agriculture (methane and nitrous oxide emissions) in both directions (up or down) depending on the individual implemented measures, practices and policies in the Czech Republic.

Since 2004, the Czech Republic has applied the Single Area Payment Scheme (SAPS) and "phasing in" module, according to Council Regulation (EC) No. 1782/2003 of 29 September 2003, establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers. In 2010, the EU subsidies for CR attained 70 % of the EU 15 level. By the end of 2010, more than CZK 186 billion had been paid to the beneficiaries within this program (SAIF, 2011).

Cross Compliance

Cross compliance has been employed in the Czech Republic since 1 January 2009. The direct payments and other selected subsidies can be granted only on the condition that a beneficiary meets the statutory management requirements addressing the environment, public health, the health of animals and plants, and animal welfare, the GAEC standards, and minimum requirements for fertilizer and plant protection product use as part of agro-environmental measures.

The implementation of Cross Compliance should reduce direct emissions from fertilizers (N_2O) and emissions from enteric fermentation (CH_4) by improvement of breeding management and a healthier animal population.

In 2012, the scientists from Research Institute of Agricultural Engineering published an invention related to litter production of manure. Thanks to a special composting technology working with biological heat can you get rid of pathogenic microorganisms in the separated slurry, from which it is made of plastic litter for cattle. Litter is just as comfortable as straw, but the animals are cleaner and there is no contamination of their milk. Introducing a new technology will increase food safety and competitiveness of Czech farmers. Increased milk production and changes in manure management affects the balance of N_2O emissions.

Czech Rural Development Program (2007-2013)

For the new seven-year program period, the European Agricultural Fund for Rural Development (EAFRD) was founded on the basis of European Council Regulation No. 1290/2005 on the financing of the CAP. With the purpose of withdrawing finances, the Czech Republic prepared basic strategic and program documents specifying in detail the measures for meeting the objectives of the development of rural areas in the Czech Republic.

The program consists of 4 basic parts (Axis = groups of measures), each of them meeting some of its objectives, A1 - improving the competitiveness of the agricultural, food and forestry sectors falls within the first group of measures A2 - increasing biodiversity, water and soil protection and mitigating climate change is a joint objective of the second group of measures, A3 – improving the quality of life in rural areas and encouraging the diversification of economic activities there, and A4 - helping the residents of rural micro-regions (applying the "from bottom to top" principle) to work out their local development strategy and to support projects related to the development of the region they live in, called the LEADER method.

Rural development and Multifunctional Agriculture (Agriculture OP)

The program includes and specifies measures jointly financed by the guidance section of the European Agricultural Guidance and Guarantee Fund (EAGGF) and jointly financed by Financial Instrument for Fisheries Guidance (FIFG). It covers the area of the Czech Republic. The purpose of processing the Agriculture OP is to support agricultural primary production and the processing of agricultural products, to support forest and water management and to ensure the continually sustainable development of the countryside. The program also ensures i) Development and modernization of agricultural holdings, ii) Support of young farmers and iii) Diversification into non-agricultural activities.

Horizontal Rural Development Plan of the Czech Republic

The program was commenced in 2004 following approval by the European Commission. The main objective of the program was to ensure sustainable development of agriculture, the countryside and its natural resources. The program objectives included i) preservation and support of agricultural systems with low inputs, ii) protection and support of sustainable agriculture meeting environmental demands and iii) preservation and strengthening of a viable social structure in rural areas. The most important share in the total allocation was represented by agro-environmental measures related to support for less-favoured areas. By the end of 2010, more than CZK 25 billion had been paid to the beneficiaries within this program.

The implementation of the rural development program can affect the trend of GHG emissions from agriculture (methane and nitrous oxide emissions) in both directions (up or down) depending on specific implemented measures, practices and policies.

Organic farming

Organic farming is an integral part of the agricultural policy of the Czech Republic. Its importance lies not only in the production of good-quality organic-foodstuffs but mainly in the farming methods that, through their environmentally friendly influence on nature, contribute substantially to the preservation of the rural character of the countryside, especially in the mountains and foothills of the Czech Republic. An important benefit lies in reduction of nitrate leaching, retention of N in biomass before the onset of winter, increased biodiversity, creating a suitable environment for beneficial organisms and effects on plant health.

The state administers support for organic farmers through subsidies and the National Rural Development Program (see above). Disbursements under the grant in the area of organic agriculture rapidly increased during in the 1998-2009 period, from 1.9 million Euros in 1998 to 39.2 million Euros in 2009 (www.eagri.cz).

The organic farming legislation limits the number of organic farms in the area of livestock and thereby reduces the number of animals and CH_4 emissions from enteric fermentation and manure storage. Organic farming does not use industrial fertilizers, the production of which creates large amounts of CO_2 and for the growing of feed for organic farming is based on substantially reduced use of inorganic fertilizers. Pesticides (herbicides) and growth regulators and the resulting production CO_2 emissions are prohibited in organic agriculture. Organic farming promotes the application of nitrogen at the appropriate time, when its uptake by plants is greatest, and thus reduces the amount of N in the soil and N_2O emissions, which are determined on the amount of N in the soil.

Action Plan for Organic Farming Development 2011-2015

Adopted by the Government on 14th December 2010, the Action Plan describes the strategy for the development of organic farming in the Czech Republic to 2015. At present approximately 483,176 hectares of land in CZ are farmed organically; this figure represents 11.4% of total agricultural acreage. In this respect, the Czech Republic is above the EU average [**Chyba! Nenalezen zdroj odkazů.**]. The main objective is to address the relationship of organic agriculture to the environment and animal welfare. Rules for housing livestock with access to outdoor runs or for providing pasture for breeding are also related to good quality management and welfare. The Action Plan is intended to achieve a level of 15% of agricultural land devoted to organic farming, while increasing the share of the organic food market to 3%. This discrepancy is mainly caused by the fact that organic farming also performs non-productive functions, and not only a production function. Approximately 80 % of the acreage in organic farming corresponds to permanent grassland.

Decree 79/2007 defines the conditions for implementation of agro-environmental measures. These measures include

a) environmentally friendly subordinate processes, which are divided into organic farming and integrated production,

b) management of grassland

c) the landscape, which is divided into i) conversion to grassland, ii) growing crops and iii) bio-corridors.

Act No. 242/2000 concerns ecological agriculture. This act administers and describes the activities of agro-environmental programs (implementation of new technologies, procedures in protected areas, landscape cultivation, etc). Directives 834/2007 and 889/2008 have been adopted and implemented in the Czech Republic.

Nitrate Directive

Action Program No. 103/2003 is closely linked to the Nitrates Directive (91/676/EEC). The program consists of a system of compulsory measures in vulnerable areas to reduce the risk of nitrogen leaching into surface waters and groundwaters. Endangered and protected areas were delimited in the Czech Republic in 2003. Since 2004, Action Plans have been implemented in these areas.

The list of endangered and protected areas was updated in December 2012, when the Third Action Plan has been implemented (incl. in WAM scenario). The limit of 170 kg N/ha for application of organic fertilizers is presented, thereby reducing the amount of N in the soil and emissions of N_2O. The Third Action Plan brings new rules: i) period of prohibition of fertilization, ii) manure storage rules, iii) balancing fertilization, iv) an application of fertilization on sloping, wet, frozen and snow covered land, in vulnerable areas.

Good Agricultural Practices, applied in ecological farms, include BAT technologies and techniques as: reduction of waste nitrogen by phase diets in feed, reduction of ammonia emission by adding enzyme substances to feed, partly grated floor, plastic and concrete grids with vacuum system removes manure, steel manure storage tanks etc.

Identification and implementation of appropriate measures in Forestry

The potential for mitigation in relation to forestry activities is mainly connected to:

– Afforestation of agricultural land with low productivity

– Replacing fossil energy with bioenergy, including from harvesting residues.

– Replacing greenhouse gas intensive materials with harvested wood products.

The most important land category of the Czech LULUCF sector in terms of greenhouse gas emission balance is Forest Land. Forestry in the Czech Republic is regulated by the Forestry Act (The Act no. 289/1995 Coll. on Forests and Amendments to some Acts), which is the principal legislative instrument. Also this instrument does not specifically target carbon balance, but its provisions affect carbon budget and greenhouse gas emissions & removals in numerous ways indirectly.

Beyond the legislation above, the National Forest Program II for the period 2008 to 2013 (NLP II) is the basic national strategic document for forestry and forestry-related sectors. Implemented within the environmental pillar, specifically Key Action 6 lists the measures being or to be implemented to alleviate the impact of expected global climate change and extreme meteorological conditions. These measures generally focus on creating more resilient forest ecosystems by promoting diversified forest stand utilizing to the greatest possible extent natural processes, varied species composition and variability of silvicultural approaches, reflecting the current international treaties, agreements, conventions and EU directives.

The Conclusions of the Coordinating Council for the implementation of the National Forestry Program II (2013) summarized the recommendations for implementing the proposed measures of NLP II after lengthy consultations by forestry experts in the country. For the emission balance of the LULUCF sector, particularly important are the elaborated recommendations of Key Action 6 NLP II which are directly aimed at reducing the impacts of global climate change and extreme weather events.

The essence of the key measures recommended by the above material is included in the “with additional measures” (WAM) scenario above.

Species, age and spatial diversity

The aspect of species diversity is connected particularly with reduction of spruce stands and increasing the share of broad-leaved and fir trees. The number of broad-leaved trees in the natural composition of forests should be approximately three times their current quantity.

Spatial diversity means provision for adequate girth and height differentiation of the forest and is related to age and species diversity. Trees of various ages fill the space of a forest stand at various levels, mixing tree species with various requirements on light and temperature and with various natural root depths facilitate more effective utilization of the above-ground and soil space for the formation of biomass capturing carbon, and trees of various sizes are exposed to different risk factors. Forest differentiation thus reduces the risk of extensive decomposition of the forest and substantially contributes to stabilization of carbon stocks.

Adaptation measures in this area focus on cultivation of spatial and species-related variety of tree stands using the natural processes in the greatest possible degree, while maintaining diverse composition, natural restoration processes and variability of silvicultural methods, use of wider spectre of tree species, including pioneering and advance species; we anticipate a wider use of species with broader ecological amplitude and stabilization function.

These are **continuously implemented** measures as defined in Principal Forestry Policy (Government Resolution No. 249/1994) and the Forests Act (Act No. 289/1995 Coll.).

Prioritising natural restoration of forests

Natural restoration of forests should be taking place on at least 20% of the total area. In order to ensure that these processes take place, it is necessary to minimise technical drainages of forest land, while increasing use of amelioration, pioneering and advance tree species, creation of regulated pools, smaller reservoirs etc. A funding system must be in place in order to maintain increased share of ameliorative and stabilising tree species in tree stands even after initial stabilization.

These measures are a part of existing legislation and require additional support to extend their application.

Implementation of sounder management methods and elimination of pressure from game

Sounder management methods reduce the use of clear-cutting and prefer noncompartmentalized or undergrowth forms of management and natural renewal, contributing to increasing the species, spatial and genetic diversity of forest ecosystems. High numbers of game do not permit natural renewal with a suitable species composition and cause further damage and are a demonstrable limiting factor for effective introduction of adaptation measures in relation to climate change. Game populations must therefore be limited to a degree that is manageable for forest ecosystems, so as to allow natural restoration of an entire spectre of tree species, without having to apply measures for area-wide forest protection.

Timber production must comply with processes limiting or slowing down surface rainfall water runoff, or be accompanied by sufficient measure combating soil erosion.

These measures are being **implemented only marginally** and require more prominent support.

Reduction of the risk with respect to increased populations of insect pests, vascular mycosis and especially root rot

Measures aiming to eliminate or reduce risks due to an increase of populations of insect pests monitoring of the state of health of forests and the dynamics of insect pest populations (by satellite and air-borne monitoring, insect traps etc.)

In addition to the use of traditional methods for liquidation of insect pests, chemical means with minimum impact on the other components of nature are also used in calamity situations in exceptional cases and to a minimum degree (where possible biological means are preferred).

These measures are being **implemented already.**

Stabilization of carbon volumes bound in forest ecosystems

Promoting forest management techniques ensuring permanent soil cover with long-term or uninterrupted recovery periods with the objective of minimising fluctuations in top humus layers and use of tree species with high primary production and favourable effect on pedosphere support stabilization of accumulated carbon. Another necessary measure is represented by stabilization of area in terms of forest types groups influenced by water and protection of wetlands in forests.

It is expected that these measures will continue to be implemented within the framework of the new programming period of the Rural Development Programme 2014-2020, especially in terms of support provided to increased share of ameliorative and strengthening tree species using the forestry-environmental payments. Maintenance of the existing high-quality ecosystems will contribute to maintenance or strengthening of increased sequestering potential of forest soil and stocking in forest biomass.

These measures are predominantly **planned** measures to be implemented in the next programming period 2014-2020.

Measures within the National Forestry Programme

The updated version of the National Forestry Programme 2013 (Government Resolution No. 1221/2008) contains the following measures aiming to reduce climate change impacts, focusing on:

- Supporting species and ecotypes of more resilient tree populations which are able to maintain high and stable production of wood;
- Supporting ecologically suitable afforestation of farming land especially by fast-growing tree species;
- Extending statutory deadlines for afforestation and ensuring tree cover in connection with natural recovery of forests;
- Reducing soil degradation and increasing volumes of carbon stocked in soil;
- Focusing subsidy rules on support to be provided toward adaptation measures reducing climate change impact.

These principles were gradually implemented within OPE (2007 – 2013), Rural Development Programme (2007 – 2013) and Programme of renewal of the natural functions of the landscape (2009 – 2018). It is anticipated that support will continue to be granted in the next programming period within the Rural Development Programme 2014-2020.

Biomass Action Plan 2012 -2020

The Biomass Action Plan analyses the potential of biomass utilisation for energy use in the Czech Republic by 2020. The potential for energy use was estimated at 133.9 – 186.8 PJ by 2020 for agricultural biomass and 26.3 – 30.4 PJ for forest dendromass while guaranteeing the condition of 100% food security. The total figure corresponds to doubling the energy use of biomass by 2020 from the current figure. The energy potential of biodegradable waste was estimated at additional 28 PJ by 2020.

The main conclusions and recommendations of the Biomass Action Plan are:

- Agricultural and forestry biomass could potentially constitute up to 16 – 20 % of final energy consumption by 2020;

- Support to energy use of biomass from waste, residues and agricultural by-products should be prioritized;
- Support for highly-efficient use of biomass (co-generation), increased use of biomass for domestic heating and sustainable production of bioenergy crops could also address other serious environmental issues.