

Submission under the Ad-hoc Working Group on Further Commitments for Annex I Parties under Kyoto Protocol (AWG-KP)

Land Use, Land Use Change and Forestry

Ukraine presents data on the amount of sinks and emissions of greenhouse gases resulted from forest management. An agreed series of data for estimation of anthropogenic emissions from sources and absorptions by sinks of greenhouse gases not regulated by Montreal Protocol for 1990-2008 has been prepared in Ukraine up-to-date. In order to prepare the report in terms of activities according to Article 3.4 of the Kyoto Protocol the development of initial data base for the description of activities regulated by the Article 3.3 and Article 3.4 of the Kyoto Protocol is finalizing. The data set for the description of the mentioned types of activities was prepared according to the international requirements for the lands under anthropogenic impacted forest, forests administered by the State Forest Resources Agency of Ukraine. The data collection for the other institutions which are responsible for forest lands is carried out.

I. Data for establishment of reference level of sinks in managed forests

The method on biomass increase is applied in the Ukrainian National Inventory Report of anthropogenic emissions from sources and absorptions by sinks of greenhouse gases not regulated by Montreal Protocol for 1990-2008 for the purpose to estimate the annual carbon stock changes within the forest lands.

According to the Forest Inventory Report of Ukraine (2006), forest is the type of ecosystem consisted mainly of wood and shrub vegetations with relevant soils, herbs, animals, microorganisms and other natural components, which are interconnected in its development and have an influence on each other and on the environmental.

For the Kyoto Protocol purposes, forests are a minimum area of 0,1 ha with width not less than 20 meters, a minimum coverage of crowns of 30% (or equivalent of stock level) and with a tree minimum height of 5 meters at maturity. An integral part of forest is forest lands temporarily unstocked as a result of heterogeneity of forest ecosystems, forestry or natural phenomena. A young natural stands and forest plantations which have not reached crown closure of 30% (equivalent on density - 0,3) and/or height of 5m are considered as integral part of forests temporary unstocked as a result of human activities or natural phenomena but will reach boundary values in future. The including of a minimum forest width (20m) agrees with the forest definition recommended for reporting to the Food and Agriculture Organization (FAO) and for the preparing of the Ukrainian submission report (<http://www.fao.org/forestry/site/32245/en/>).

Forest lands include stocked areas and temporarily or permanently unstocked areas. Unstocked areas includes plantations which have not form crown cover, nursery gardens, forest plantations as well as forestry roads, drainage systems, rides and firebreaks. Conducted calculations based on regional data from the statistical reporting form # 6-zem on areas of "unstocked lands" and "other forest lands" as well as on an information from the statistical reporting form #3-lkh on areas of the felling and forest fires. All information was used in terms of administrative-territorial units of Ukraine.

The territory of Ukraine includes different natural zones and therefore carbon parameters of forest vary in zonal and regional aspects. Data regarding areas and stocks of dominant species stands were taken in terms of administrative-territorial units of Ukraine with consideration of natural and

climatic zones by using statistics of the State Forest Recourses Agency of Ukraine. The boundaries of natural zones coincide with the boundaries of administrative-territorial units (Table 1) allowing to take into consideration the differences in the growth of species. At the same time, the assumption about the homology in species composition of stands within forest lands subordinated by the other economic entities was accepted.

Table 1. Distribution of the areas of administrative-territorial units of Ukraine according to the natural areas

Administrative-territorial unit	Polesye	Forest steppe	North Steppe	South Steppe	Carpathian	Crimea
Autonomous Republic of Crimea				0.1		0.9
Vinnitsya region		1				
Volyn region	0.8	0.2				
Dnipropetrovs'k region			0.9	0.1		
Donets'k region			1			
Zhytomyr region	0.8	0.2				
Zakarpattya region					1	
Zaporizhya region			0.5	0.5		
Ivano-Frankivs'k region		0.2			0.8	
Kyiv region	0.7	0.3				
Kirovohrad region		0.5	0.5			
Luhans'k region			1			
L'viv region		0.3			0.7	
Mykolayiv region			0.6	0.4		
Odesa region		0.2	0.3	0.5		
Poltava region		1				
Rivne region	0.8	0.2				
Sumy region	0.2	0.8				
Ternopil' region		1				
Kharkiv region		0.5	0.5			
Kherson region				1		
Khmelnysky region		1				
Cherkasy region		1				
Chernivtsi region		0.3			0.7	
Chernihiv region	0.8	0.2				

Practically all Ukrainian forests are affected by the economic activity and therefore the country's forests cannot be classified as virgin (primary) forests with the exception of small areas. According to the data of FAO (<http://www.fao.org/forestry/fra/fra2010/en/>) the virgin forest areas is 59 thousands of ha which have been excluded from the calculation. The hard broadleaf plantations are dominated in the species composition of Ukrainian forest areas - 43,6% of areas. The less areas are covered by coniferous and soft broadleaf (42,6%) stands. Conducted calculations include the dominant species:

- coniferous (pine, spruce, other species);
- hard broadleaf (oak, beech, other species);
- soft broadleaf (birch, alder, aspen, other species).

Besides, all other forest species are estimated as a sum (ash, poplar and other).

The total area of lands referred to the category "Forest" according to the above-mentioned definitions vary from 10,2 millions of ha in 1990 till 10,57 millions of ha in 2008 that is near 17,5% of country's area. Due to changes in the age structure, the total wood stock in the country's forests is constantly increasing. As of 1996 this total stock exceed 1,74 billions of m³, at the same time the

increase of stem biomass is near 35 millions of m^3 and in 2008 these indicators reached 1,8 billions of m^3 and 35,8 of m^3 , respectively. The volume of annual fellings as a general reserve of timber are increasing during recent years. They reached 19,0 million of m^3 in 2007 and were slightly reduced up to 17,7 million of m^3 in 2008. Forestry rules require plantings of a new forest on the clean felling lands during one- two years. Such plantings were conducted annually within the area of 30-40 hectares over the past few years. At the same time near 20% of fellings were naturally covered by woody vegetation. Starting from 2006 a stable tendency to increase the afforestation (new forest creation) was observed in Ukraine.

Equations and conversional factors for living vegetation carbon pools are provided in Chapter III.2 of the National Inventory report of Ukraine of anthropogenic emissions from sources and absorptions by sinks of greenhouse gases for 1990-2008. The carbon stocks of dead wood in the forest (dead-tree and fallen deadwood) are estimate on the basis of factors of wood stocks' volume in the pool which are derived from the monitoring observation cycle conducted by the Ukrainian Research Institute of Forestry and Forest Melioration named after G. M. Vysotsky – UkrNRIFFM (V.P.Pasternak, V.Y.Yarotskiy, 2010).

The result of national researches was used for estimation of forest litter stock ($t\cdot ha^{-1}$). According to result of the above-mentioned researches and the analysis of the literature sources, UkrNRIFFM developed the models of the dynamics of forest litter accumulation by main species (coniferous and broad-leaved) with regard to the growing conditions.

The average carbon stock in the different age groups per area unit was used for the calculation. The final value was obtained as a result of multiplication of average value by area under forest plantations of each age group.

The value of carbon stocks in the soil of managed forest did not estimate at this stage. There are researches on the factor calculation for the stock carbon change in deadwood, forest litter and soil in Ukraine. The preliminary data for deadwood and forest litter were received at this stage.

The final stage for the estimation of carbon stock is the summation over age groups with obtaining of the final value for the relevant dominant species for each pool. Then, the summation over dominant species is carried out for sum obtaining for each nature zone and all Ukraine. The value of the carbon absorption by biomass pool in overmaturity stands is taken to be equal to zero.

There are also GHG emissions within the managed forest. Its estimation is carried out in case of fire, fellings, draining of forest lands. Carbon losses of forest ecosystems as a result of fellings and fires are estimated on the base of average value for all forests. CO_2 emissions from forest fires were calculated according to the methodology IPCC (Good Practice Guidance...., 2003).

The data on wood harvesting in Ukrainian forests were used to estimate the volume of biomass for wood harvesting. This information for 1990-2008 was received on the basis of data of the State Committee of Statistics of Ukraine, form #3-lkh. The statistics on wood harvesting were deduced according to the general value in m^3 of felled wood (i.e. include merchantable wood and waste). The conversion factors 1,15 (for estimation of all biomass) and 0,5 (for recalculation of volume units in tons) with consideration of the base density of wood were used in order to recalculate the volume of wood harvesting in dry biomass tons. Share of carbon was taken by default according to the IPCC methodology (Good Practice Guidance...., 2003). Other carbon losses on the managed forest lands include losses from natural disaster such as windbreaks, damage by pests and diseases, and fires. The no- CO_2 GHG emissions are also estimated in case of losses from fires in the managed forest lands, including wildfires and controlled fires. The methodology by default is used for estimation of other losses (Good Practice Guidance...., 2003). It provides for complete destruction of forest biomass in case of natural disaster. At the same time only natural disasters which completely destroy forest plantations are taking into consideration. The forestry practice in this case usually provides that the damaged wood from the stands needs to be removed with following reforestation.

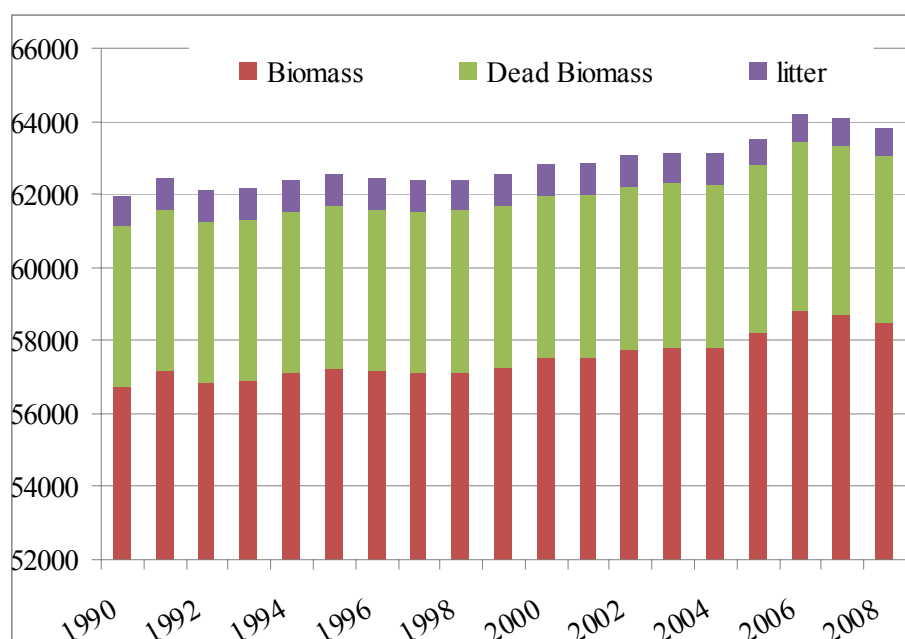
22,6 - 23,3 Mt of C·year⁻¹ are absorb by managed forests. Near 85% of carbon are absorb by living biomass pool, 13% - by dead biomass and near 1% is reserved by litter pool (table 2, picture 1)

Table 2. *Accumulation of carbon in managed forests, th. tones of C*

Year	Biomass	Dead wood	Forest litter	Total
Coniferous				
1990	7095,5	513.6	125,7	7734.8
1991	7129,0	522.5	126,3	5897.2
1992	7118,7	515.2	126,1	5888.3
1993	7124,9	515.9	126,3	5895.8
1994	7147,4	517.6	126,7	5915.1
1995	7186,6	519.4	127,1	5936.4
1996	7181,6	519.0	127,0	5930.9
1997	7191,7	518.6	127,2	5941.2
1998	7206,0	519.9	127,2	5941.3
1999	7219,3	521.0	127,5	5954.1
2000	7244,6	523.0	128,0	5976.9
2001	7249,0	523.3	128,1	5980.0
2002	7257,0	524.0	128,3	5988.9
2003	7266,4	524.7	128,4	5996.5
2004	7266,1	524.7	128,4	5996.5
2005	7269,8	530.4	99,8	6061.3
2006	7345,8	535.7	100,5	6121.9
2007	7333,6	534.7	100,3	6111.1
2008	7309,6	532.7	100,0	6087.8
Hard broadleaved				
1990	6256,6	510.6	75,9	6843.0
1991	6282,9	499.6	76,2	5859.8
1992	6263,4	511.0	75,9	5840.2
1993	6263,4	511.2	75,9	5842.8
1994	6281,9	512.7	76,2	5859.8
1995	6257,7	509.5	75,7	5823.3
1996	6242,4	508.2	75,5	5807.5
1997	6259,4	507.4	75,7	5825.4
1998	6212,3	505.1	75,0	5772.9
1999	6231,9	506.9	75,3	5793.1
2000	6263,8	509.4	75,7	5822.0
2001	6267,0	509.6	75,7	5824.3
2002	6303,7	512.9	76,2	5861.6
2003	6316,0	513.9	76,3	5873.3
2004	6314,2	513.7	76,3	5871.3
2005	6320,7	520.5	72,3	5948.1
2006	6437,1	531.4	73,6	6073.5
2007	6423,3	530.2	73,4	6059.4
2008	6388,3	527.0	73,0	6023.0
Soft broadleaved				
1990	2065,1	172.6	25,6	2263.3
1991	2074,4	175.7	25,7	1981.0

Year	Biomass	Dead wood	Forest litter	Total
1992	2072,4	173.2	25,7	1979.1
1993	2076,9	173.5	25,8	1983.3
1994	2084,7	174.2	25,9	1990.7
1995	2111,3	176.3	26,2	2014.6
1996	2107,8	176.0	26,1	2011.3
1997	2110,9	175.8	26,2	2014.3
1998	2110,4	176.2	26,2	2013.2
1999	2115,4	176.6	26,2	2018.0
2000	2124,5	177.3	26,3	2026.8
2001	2126,6	177.5	26,4	2028.8
2002	2129,4	177.8	26,4	2031.7
2003	2132,1	178.0	26,4	2034.4
2004	2133,5	178.1	26,5	2035.7
2005	2224,1	185.9	25,8	2124.9
2006	2197,8	183.5	25,4	2097.1
2007	2194,1	183.2	25,4	2093.5
2008	2187,6	182.6	25,3	2087.0
Others				
1990	55,7	5.3	0,8	61.8
1991	55,9	4.7	0,8	55.5
1992	55,6	5.3	0,8	61.6
1993	55,8	5.3	0,8	61.9
1994	55,9	5.3	0,8	62.0
1995	54,8	5.2	0,8	60.8
1996	54,5	5.2	0,8	60.5
1997	54,8	5.2	0,8	60.2
1998	53,8	5.1	0,8	59.6
1999	54,1	5.1	0,8	60.0
2000	54,1	5.1	0,8	60.0
2001	54,0	5.1	0,8	59.9
2002	54,5	5.2	0,8	60.4
2003	54,7	5.2	0,8	60.6
2004	54,6	5.2	0,8	60.5
2005	65,1	6.2	0,9	72.2
2006	66,6	6.4	0,9	73.8
2007	66,3	6.3	0,9	73.5
2008	65,4	6.3	0,9	72.5
Total for managed forests				
1990	15472,8	1202.1	228,0	16903.0
1991	15542,2	1202.5	229,0	17020.5
1992	15510,1	1204.7	228,5	16943.3
1993	15521,1	1206.0	228,8	16955.9
1994	15569,9	1209.8	229,5	17009.2
1995	15610,5	1210.5	229,8	17050.7
1996	15586,3	1208.3	229,4	17024.0
1997	15616,8	1207.0	229,9	17008.0
1998	15582,5	1206.2	229,2	17017.9
1999	15620,7	1209.6	229,8	17060.1
2000	15687,0	1214.9	230,8	17132.6
2001	15696,6	1215.5	230,9	17143.0

Year	Biomass	Dead wood	Forest litter	Total
2002	15744,5	1219.9	231,6	17196.0
2003	15769,3	1221.8	232,0	17223.0
2004	15768,4	1221.7	232,0	17222.1
2005	15879,8	1243.0	198,8	17321.5
2006	16047,3	1257.0	200,4	17504.7
2007	16017,2	1254.5	200,0	17471.7
2008	15950,9	1248.6	199,1	17398.6



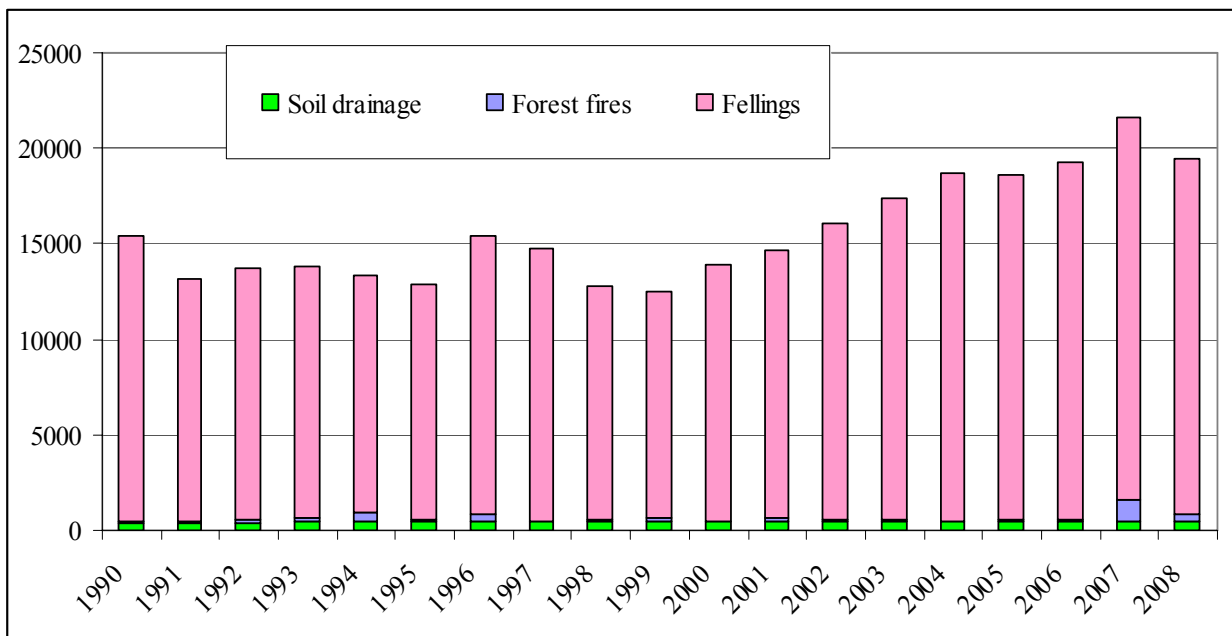
Picture. 1 Absorption of CO₂ within the period 1990-2008, th. tones of C

Carbon losses as a result of fellings, fires and other factors in managed forests changed from 4,2 to 5,3 Mt C year⁻¹ (th. t C) (at the average of 4,2 Mt C year⁻¹) (table 2, picture 2)

Table 3. Carbon losses in managed forest, th. tones of C

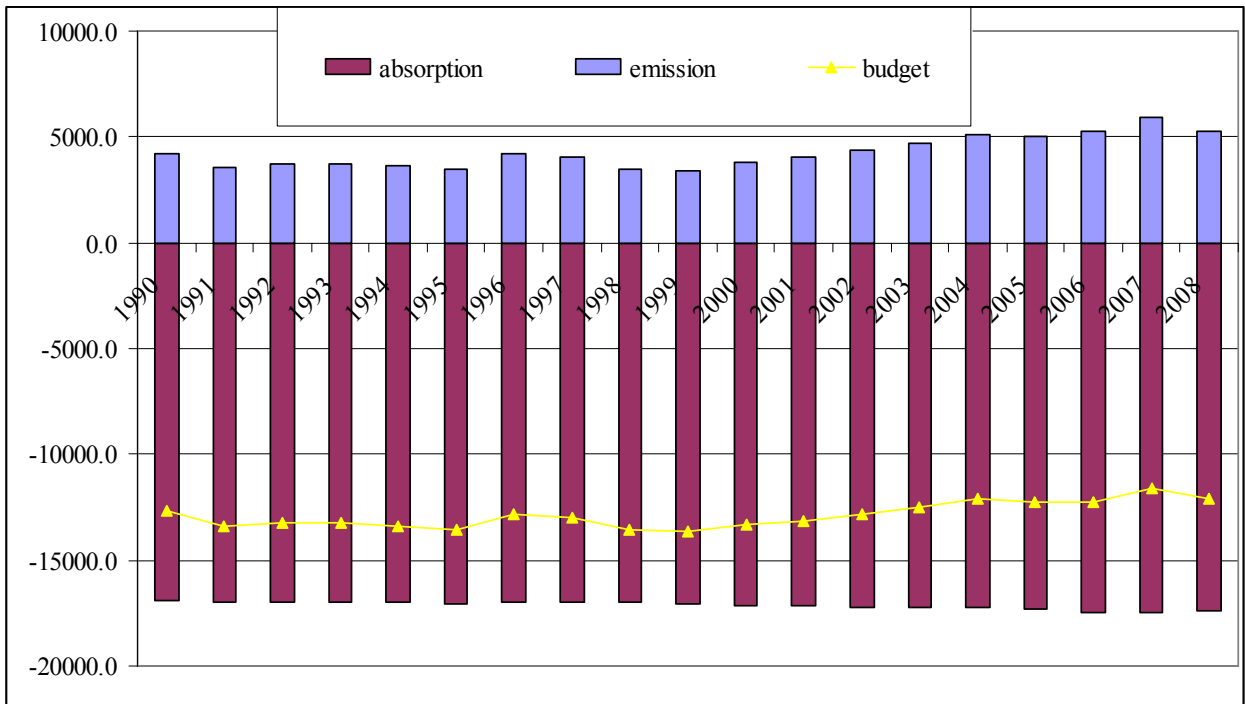
Year	Emissions in managed forests, th. tones of C			
	Forest fires	Fellings	Soil drainage	Total
1990	25,0	4061,7	115,3	4202,0
1991	14,5	3467,5	115,3	3597,3
1992	36,0	3597,8	115,3	3749,1
1993	49,2	3592,9	120,8	3762,9
1994	140,9	3387,5	121,2	3649,6
1995	42,5	3349,7	121,6	3513,8
1996	112,2	3962,3	121,3	4195,8
1997	7,9	3894,7	121,7	4024,3
1998	41,3	3312,3	122,7	3476,3
1999	54,7	3232,7	123,8	3411,2
2000	10,2	3661,6	124,9	3796,7
2001	42,2	3842,6	126,0	4010,8
2002	33,3	4224,0	126,7	4384,0
2003	16,7	4586,6	127,8	4731,1
2004	2,6	4973,9	128,0	5104,5

2005	15,6	4923,2	128,2	5067,0
2006	26,6	5105,9	129,8	5262,3
2007	314,3	5466,5	127,4	5908,2
2008	100,0	5085,2	124,9	5310,1



Picture 2. Losses of CO₂ in managed forests for 1990-2008, th. tones of C

Considerable part of carbon losses was related with wood harvestings witch increased by the second part of 2000 and that was reflected in the national statistics (statistical reporting form #3-lkh of the Sate Committee of Statistics). For 1990-2008 the carbon absorption by Ukrainian managed forest exceeds carbon emissions at the level of 13,9-12,8 Mt C/year⁻¹ in 1990 and in 2008, respectively (picture 3).



Pic. 3. CO2 budget in managed forests of Ukraine without area under bushes (in sum over pools of biomass, dead wood, litter and soil) td.t C

Final calculations of carbon balance value within managed forests of Ukraine include provided complex of measures on forest management: forest-use, revegetation after fellings, fires or other infractions, measures on forest protection and defence. Almost all Ukrainian forests fall into the category of managed forest. Insignificant part of forest (59 td. ha) is virgin (primary, wild hyacinth).

II. Prediction

The data of the State special-purpose programme “Forests of Ukraine” for 2010-2015 were used for prediction. The extrapolation method of prediction value on the basis of data for 2015 was used for predictive estimate for the period after 2015. According to the programme “Forests of Ukraine” for 2010-2015 the measures on management of forestry were planned to realized within all territory under stands (information on value of planned works indicated in table 4)

Table 4. Expectable results of realization of the State special-purpose programme “Forests of Ukraine” for 2010-2015

Measures	Indicator of task compliance	Measurement unit	Indicators meaning					
			total	which includes, years				
				2011	2012	2013	2014	2015
Social-ecological								

Measures	Indicator of task compliance	Measurement unit	Indicators meaning					
			total	which includes, years				
				2011	2012	2013	2014	2015
Increasing of resource and ecological potential of forests, ensuring of forest management from a perspective of the sustainable development	Area of reforestation ¹	td. ha	192,7	38,3	38,5	38,5	38,7	38,7
Increasing of forest ecosystems' resistance, insurance of its protection and defence	Area of felling forming and hygienics of forest	td. ha	1841,4	373,2	366,9	365,4	367,2	368,7
	Value of general cut timber stock from harvesting, forming and hygienics of forest	td. m ³	38159,1	7585,5	7613,9	7610,1	7683,2	7666,4
	Extent of fireproof break, fire lines	td. km	1487,52	295,31	296,69	297,45	298,82	299,25
	Areas which are the subject to provide the measures on forest protection	td. ha	1808,2	370,1	364,1	363	361,3	349,7
Economical								
Increase of forest management efficacy	Areas which are the subject for basic forest management	td. ha	3776,8	1394	733	1006	432	211,8
	Areas which are the subject for the forest inventory	td. ha	29600	2000	3000	3000	10800	10800

¹ Forestry practice of Ukraine provides that the activities on reforestation completely fall under the activities indicated in Article 3.4 of the Kyoto Protocol (reforestation within lands of fellings, fires, wood destruction on the forest management areas)

Measures	Indicator of task compliance	Measurement unit	Indicators meaning					
			total	which includes, years				
				2011	2012	2013	2014	2015
	Areas which are the subject for the state forest inventory	td. ha	21800	10800				11000
Rational forest source use								
	Value of harvesting wood from felling for merchantable wood main use	td. m ³	36919,6	7337,4	7360,9	7387,3	7406,8	7427,2
	extent of reconstructed and restore roads for forestry use	km	7997	1607,9	1572,9	1595,4	1615	1605,8

Different methods and approaches which are similar to those that had been used to estimate the carbon stock change for 1990-2008 were applied for the predictive estimate. At present the first result of factors for carbon dynamics in dead wood pools (dead-tree and fallen deadwood) and forest litter were obtained. The results of the predictive estimate are illustrated in Table 5.

Table 5. Predicted value of carbon annual budget as a result of activities within managed forest of Ukraine for 2011 – 2020.

Year	Living biomass, million. t. C/year		Total for managed forests, million. t. C/year	
	Average	Uncertainty, %	Average	Uncertainty, %
2010	15.9	15,04	14.1	14,77
2011	16,1	15,01	14.3	14,74
2012	16.3	14,96	14.5	14,69
2013	16.5	14,87	14.8	14,60
2014	16.8	14,80	15.0	14,53
2015	17,1	14,68	15.4	14,42
2020	17.3	14,60	15.7	14,33

Predictive estimate were developed on the basis of State special-purpose programme “Forests of Ukraine” for 2010-2015. According to this strategy the planning increase of fellings from 14,9 million of m³ in 2011 till 15,1 million of m³ in 2015 is expected. The stabilization of felling value is expected after 2015.

III. Data on forest management.

A	B	C	D	E	F	G	I
1990 emissions/removals (MtCO ₂)	Proposed reference level & reference interval (if	Projection for 1 st CP 3 (MtCO ₂)	Projection for 2013-2020 (MtCO ₂)	Projection based on 1990 (MtCO ₂)	Projection based on reference level	Projection based on 1 st CP (MtCO ₂ e/yr)	Comments

e/yr	any) (MtCO ₂ e/yr)	e/yr	e/yr	e/yr (E=D-A)	(MtCO ₂ e/yr) (F=D-B)	(G=D-C)	
-46.6	-46.6 from 0 to -51,0 million t of . CO ₂ e/yr	-48.7	-50.0	-3.4	-3.4	-1.3	Structures of forests, species distribution was taken into consideration for projection 2013-2020. Data for predicted value were received on the basis of interpolation of data for 2008 and 2009.