

Module LULUCF
 Submodule Forest remaining Forest
 Carbon stock change in living biomass
 Sheet Carbon release from harvesting in *Pinus radiata* plantations (temperate) and native forests

	Stem volume in plantation forest harvest ¹ (merch. m ³)	Biomass conversion ratio ² (t dm/m ³)	Dry matter in stem ^{1,3} t C/t dm = 0.5 (t dm)	Carbon in plantation forest harvest ¹ (t C)	Stem volume in native forest harvest (merch. m ³)	Biomass conversion ratio (t dm/m ³)	Biomass expansion ratio (t dm/m ³)	Dry matter in total native forest harvest (t dm)	Carbon in native forest harvest (t C) t C/t dm = 0.5	Carbon release from total forest harvest (t C)
1990	10,813,787	0.497	5,375,576	2,687,788	365,000	0.50	2.04	372,300	186,150	2,873,938
1991	11,797,488	0.483	5,695,944	2,847,972	307,667	0.50	2.04	313,820	156,910	3,004,882
1992	12,500,583	0.482	6,029,456	3,014,728	257,333	0.50	2.04	262,480	131,240	3,145,968
1993	13,232,522	0.482	6,373,329	3,186,664	205,000	0.50	2.04	209,100	104,550	3,291,214
1994	13,987,203	0.479	6,698,479	3,349,240	158,000	0.50	2.04	161,160	80,580	3,429,820
1995	14,700,793	0.472	6,932,502	3,466,251	107,333	0.50	2.04	109,480	54,740	3,520,991
1996	15,214,390	0.455	6,926,911	3,463,455	50,000	0.50	2.04	51,000	25,500	3,488,955
1997	15,202,119	0.472	7,174,913	3,587,457	56,667	0.50	2.04	57,800	28,900	3,616,357
1998	15,746,397	0.482	7,596,912	3,798,456	57,667	0.50	2.04	58,820	29,410	3,827,866
1999	16,672,535	0.498	8,305,796	4,152,898	57,000	0.50	2.04	58,140	29,070	4,181,968
2000	18,228,285	0.493	8,981,586	4,490,793	38,333	0.50	2.04	39,100	19,550	4,510,343
2001	19,711,404	0.472	9,304,012	4,652,006	23,000	0.50	2.04	23,460	11,730	4,663,736
2002	20,419,017	0.459	9,371,459	4,685,729	16,333	0.50	2.04	16,660	8,330	4,694,059
2003	20,508,697	0.459	9,421,909	4,710,955	10,333	0.50	2.04	10,540	5,270	4,716,225

All data are three-year straight averages.

¹ Estimated using Forest Research models.

² Derived from the model results contained in columns 1 and 3.

³ No adjustment from stem volume to total biomass volume is made here as on-site decay is accounted for in the carbon uptake data.

Module LULUCF
 Submodule Forest remaining Forest
 Worksheet Carbon stock change in living biomass
 Sheet Carbon uptake in *Pinus radiata* plantations (temperate)

	Total forest estate area (net of harvest) (ha)	Total Forest estate carbon (net of harvest) (t C)	Forest estate carbon uptake (net of harvest) (t C)	Carbon in plantation forest harvest (t C)	Total forest carbon uptake (before harvest) (t C)
1990	1,219,430	116,176,914	6,370,915	2,687,788	9,058,703
1991	1,248,034	122,306,137	6,129,224	2,847,972	8,977,196
1992	1,288,486	127,955,851	5,649,714	3,014,728	8,664,442
1993	1,351,055	133,108,509	5,152,657	3,186,664	8,339,322
1994	1,426,089	138,037,423	4,928,914	3,349,240	8,278,154
1995	1,508,665	142,872,726	4,835,303	3,466,251	8,301,554
1996	1,585,196	147,819,449	4,946,723	3,463,455	8,410,178
1997	1,654,972	153,194,165	5,374,716	3,587,457	8,962,173
1998	1,711,807	159,077,011	5,882,846	3,798,456	9,681,302
1999	1,758,009	165,567,822	6,490,811	4,152,898	10,643,709
2000	1,796,162	172,556,270	6,988,448	4,490,793	11,479,241
2001	1,828,624	179,724,098	7,167,828	4,652,006	11,819,834
2002	1,855,950	186,832,330	7,108,232	4,685,729	11,793,962
2003	1,877,472	193,815,031	6,982,700	4,710,955	11,693,655

All data are three year straight averages.

Data were estimated using Forest Research Institute models.

Module LULUCF
 Submodule Forest remaining Forest
 Worksheet Carbon stock change in living biomass
 Sheet Net Carbon uptake in forest

	Total forest carbon uptake (before harvest) (Gg C)	Carbon release from total forest harvest (Gg C)	Net carbon uptake in forests (Gg C)	Net CO ₂ uptake in forests (Gg CO ₂)
1990	9,059	2,874	6,185	22,677
1991	8,977	3,005	5,972	21,898
1992	8,664	3,146	5,518	20,234
1993	8,339	3,291	5,048	18,510
1994	8,278	3,430	4,848	17,777
1995	8,302	3,521	4,781	17,529
1996	8,410	3,489	4,921	18,044
1997	8,962	3,616	5,346	19,601
1998	9,681	3,828	5,853	21,463
1999	10,644	4,182	6,462	23,693
2000	11,479	4,510	6,969	25,553
2001	11,820	4,664	7,156	26,239
2002	11,794	4,694	7,100	26,033
2003	11,694	4,716	6,977	25,584

All data are three year straight averages.

Data were estimated using Forest Research Institute models.

Module LULUCF
Submodule Land converted to Forest
Worksheet
Sheet Carbon release from grassland (woody vegetation) cleared for new forest planting

	Grassland cleared for forest planting ¹ (ha)	Clearance where vegetation burned ² (25% of total) (ha)	Quantity of biomass burned (t dm/ha = 136) (t dm)	Oxidised biomass (90% of total) (t dm)	C release from burning vegetation (t C/t dm = 0.5) (t C)	CO2 release from burning for new planting (t CO2)	Clearance where grassland decays ² (75% of total) (ha)	Initial quantity of biomass to decay ³ (t dm/ha=136) (t dm)	C release from decay (t C/t dm = 0.5) (t C)	CO2 release from decay for new planting (t CO2)
1990	3,579	895	121,679	109,511	54,756	200,771	2,684	365,038	182,519	669,236
1991	5,427	1,357	184,507	166,056	83,028	304,436	4,070	553,520	276,760	1,014,787
1992	8,480	2,120	288,320	259,488	129,744	475,728	6,360	864,960	432,480	1,585,760
1993	11,200	2,800	380,800	342,720	171,360	628,320	8,400	1,142,400	571,200	2,094,400
1994	12,464	3,116	423,776	381,398	190,699	699,230	9,348	1,271,328	635,664	2,330,768
1995	9,376	2,344	318,773	286,895	143,448	525,975	7,032	956,318	478,159	1,753,250
1996	10,323	2,581	350,971	315,874	157,937	579,102	7,742	1,052,912	526,456	1,930,339
1997	9,263	2,316	314,953	283,458	141,729	519,673	6,948	944,860	472,430	1,732,243
1998	4,662	1,166	158,508	142,657	71,329	261,538	3,497	475,524	237,762	871,794
1999	5,847	1,462	198,809	178,928	89,464	328,035	4,386	596,428	298,214	1,093,451
2000	5,905	1,476	200,759	180,683	90,341	331,252	4,429	602,276	301,138	1,104,173
2001	6,662	1,666	226,519	203,867	101,934	373,757	4,997	679,558	339,779	1,245,856
2002	4,880	1,220	165,920	149,328	74,664	273,768	3,660	497,760	248,880	912,560
2003	4,654	1,164	158,236	142,412	71,206	261,089	3,491	474,708	237,354	870,298

All data are three year straight averages

¹ Ministry of Agriculture and Forestry

² Percentage assumed for calculation purposes.

Module LULUCF
Submodule Grassland remaining grassland/forest land remaining forest land
Worksheet
Sheet Carbon release from wildfires

	Area of grassland burned in wildfires ¹ (ha)	Quantity of biomass burned (t dm/ha = 136) (t dm)	Oxidised biomass (90% of total) (t dm)	C release from wildfires (t C/t dm = 0.5) (t C)	Area of Forest burned in wildfires ¹ (ha)	Quantity of biomass burned (t dm/ha = 364) (t dm)	Oxidised biomass (90 % of total) (t dm)	C release from forest wildfires (t C/t dm = 0.5) (t C)
1990	2,564	348,738	313,864	156,932	323	117,663	105,897	52,948
1991	2,064	280,659	252,593	126,296	207	75,318	67,786	33,893
1992	1,954	265,744	239,170	119,585	165	60,151	54,136	27,068
1993	2,330	316,812	285,131	142,565	239	86,814	78,133	39,066
1994	2,529	343,978	309,580	154,790	314	114,266	102,839	51,420
1995	2,645	359,765	323,789	161,894	472	171,929	154,736	77,368
1996	2,532	344,318	309,886	154,943	727	264,598	238,138	119,069
1997	3,320	451,565	406,409	203,204	762	277,520	249,768	124,884
1998	3,268	444,391	399,952	199,976	692	251,949	226,754	113,377
1999	3,049	414,709	373,238	186,619	403	146,571	131,914	65,957
2000	2,119	288,184	259,366	129,683	334	121,576	109,418	54,709
2001	1,954	265,789	239,210	119,605	282	102,648	92,383	46,192
2002	2,165	294,440	264,996	132,498	283	102,891	92,602	46,301
2003	2,236	304,096	273,686	136,843	287	104,468	94,021	47,011

Module LULUCF
Submodule Forest land remaining forest land
Worksheet
Sheet Non-CO2 emissions from the on-site burning of forests

	Carbon release by on-site burning (t C)	Nitrogen released (t N/t c = 0.01) (t C)	Carbon in CH ₄ emissions (ratio = 0.012) (t C)	Nitrogen in N ₂ O emissions (ratio = 0.007) (t N)	Nitrogen in NO _x emissions (ratio = 0.121) (t N)	Carbon in CO emissions (ratio = 0.06) (t C)	CH ₄ emissions from burning (ratio = 1.333) Gg CH	N ₂ O emissions from burning (ratio = 1.571) (Gg N ₂ O)	NO _x emissions from burning (ratio = 3.286) (Gg NO _x)	CO emissions from burning (ratio = 2.333) (Gg CO)
1990	52,948	529	635	4	64	3,177	0.847	0.006	0.211	7.412
1991	33,893	339	407	2	41	2,034	0.542	0.004	0.135	4.744
1992	27,068	271	325	2	33	1,624	0.433	0.003	0.108	3.789
1993	39,066	391	469	3	47	2,344	0.625	0.004	0.155	5.469
1994	51,420	514	617	4	62	3,085	0.823	0.006	0.204	7.198
1995	77,368	774	928	5	94	4,642	1.238	0.009	0.308	10.830
1996	119,069	1,191	1,429	8	144	7,144	1.905	0.013	0.473	16.667
1997	124,884	1,249	1,499	9	151	7,493	1.998	0.014	0.497	17.481
1998	113,377	1,134	1,361	8	137	6,803	1.814	0.012	0.451	15.870
1999	65,957	660	791	5	80	3,957	1.055	0.007	0.262	9.233
2000	54,709	547	657	4	66	3,283	0.875	0.006	0.218	7.658
2001	46,192	462	554	3	56	2,771	0.739	0.005	0.184	6.466
2002	46,301	463	556	3	56	2,778	0.741	0.005	0.184	6.481
2003	47,011	470	564	3	57	2,821	0.752	0.005	0.187	6.581

Module LULUCF
Submodule Grassland remaining grassland
Worksheet
Sheet Non-CO2 emissions from the on-site burning of grassland - WILDFIRE ONLY

	Carbon release by on-site burning (t C)	Nitrogen released (t N/t c = 0.01) (t C)	Carbon in CH ₄ emissions (ratio = 0.012) (t C)	Nitrogen in N ₂ O emissions (ratio = 0.007) (t N)	Nitrogen in NO _x emissions (ratio = 0.121) (t N)	Carbon in CO emissions (ratio = 0.06) (t C)	CH ₄ emissions from burning (ratio = 1.333) Gg CH	N ₂ O emissions from burning (ratio = 1.571) (Gg N ₂ O)	NO _x emissions from burning (ratio = 3.286) (Gg NO _x)	CO emissions from burning (ratio = 2.333) (Gg CO)
1990	156,932	1,569	1,883	11	190	9,416	2.510	0.017	0.624	21.967
1991	126,296	1,263	1,516	9	153	7,578	2.020	0.014	0.502	17.679
1992	119,585	1,196	1,435	8	145	7,175	1.913	0.013	0.475	16.739
1993	142,565	1,426	1,711	10	173	8,554	2.280	0.016	0.567	19.956
1994	154,790	1,548	1,857	11	187	9,287	2.476	0.017	0.615	21.668
1995	161,894	1,619	1,943	11	196	9,714	2.590	0.018	0.644	22.662
1996	154,943	1,549	1,859	11	187	9,297	2.478	0.017	0.616	21.689
1997	203,204	2,032	2,438	14	246	12,192	3.250	0.022	0.808	28.445
1998	199,976	2,000	2,400	14	242	11,999	3.199	0.022	0.795	27.993
1999	186,619	1,866	2,239	13	226	11,197	2.985	0.021	0.742	26.123
2000	129,683	1,297	1,556	9	157	7,781	2.074	0.014	0.516	18.153
2001	119,605	1,196	1,435	8	145	7,176	1.913	0.013	0.476	16.742
2002	132,498	1,325	1,590	9	160	7,950	2.119	0.015	0.527	18.547
2003	136,843	1,368	1,642	10	166	8,211	2.189	0.015	0.544	19.155

Module LULUCF
Submodule Grassland converted to forest land
Worksheet
Sheet Non-CO2 emissions from the on-site burning of grassland - CONTROLLED BURN ONLY

	Carbon release by on-site burning (t C)	Nitrogen released (t N/t c = 0.01) (t C)	Carbon in CH ₄ emissions (ratio = 0.012) (t C)	Nitrogen in N ₂ O emissions (ratio = 0.007) (t N)	Nitrogen in NO _x emissions (ratio = 0.121) (t N)	Carbon in CO emissions (ratio = 0.06) (t C)	CH ₄ emissions from burning (ratio = 1.333) Gg CH	N ₂ O emissions from burning (ratio = 1.571) (Gg N ₂ O)	NO _x emissions from burning (ratio = 3.286) (Gg NO _x)	CO emissions from burning (ratio = 2.333) (Gg CO)	
1990	54,756		548	657	4	66	3,285	0.876	0.006	0.218	7.665
1991	83,028		830	996	6	100	4,982	1.328	0.009	0.330	11.622
1992	129,744		1,297	1,557	9	157	7,785	2.075	0.014	0.516	18.162
1993	171,360		1,714	2,056	12	207	10,282	2.741	0.019	0.681	23.987
1994	190,699		1,907	2,288	13	231	11,442	3.050	0.021	0.758	26.694
1995	143,448		1,434	1,721	10	174	8,607	2.295	0.016	0.570	20.080
1996	157,937		1,579	1,895	11	191	9,476	2.526	0.017	0.628	22.108
1997	141,729		1,417	1,701	10	171	8,504	2.267	0.016	0.564	19.839
1998	71,329		713	856	5	86	4,280	1.141	0.008	0.284	9.985
1999	89,464		895	1,074	6	108	5,368	1.431	0.010	0.356	12.523
2000	90,341		903	1,084	6	109	5,420	1.445	0.010	0.359	12.646
2001	101,934		1,019	1,223	7	123	6,116	1.631	0.011	0.405	14.269
2002	74,664		747	896	5	90	4,480	1.194	0.008	0.297	10.451
2003	71,206		712	854	5	86	4,272	1.139	0.008	0.283	9.967

Module LULUCF
Submodule Carbon emissions from liming soils
Worksheet 5.5
Sheet 3 of 4 (adapted)

	Total annual amount of limestone ¹ (Mg)	Total annual amount of limestone (3yr average) (Mg)	Carbon conversion factor ²	Carbon emissions from liming (MgC)	Emissions of CO ₂ (Gg)
1989	662,753				
1990	817,127	787,329	0.12	94,479	346
1991	882,107	882,107	0.12	105,853	388
1992	947,087	951,619	0.12	114,194	419
1993	1,025,662	1,033,210	0.12	123,985	455
1994	1,126,880	1,126,880	0.12	135,226	496
1995	1,228,097	1,152,047	0.12	138,246	507
1996	1,101,163	1,180,840	0.12	141,701	520
1997	1,213,261	1,213,261	0.12	145,591	534
1998	1,325,360	1,325,360	0.12	159,043	583
1999	1,437,458	1,437,458	0.12	172,495	632
2000	1,549,556	1,549,556	0.12	185,947	682
2001	1,661,655	1,661,655	0.12	199,399	731
2002	1,773,753	1,666,600	0.12	199,992	733
2003	1,564,392	1,634,179	0.12	196,101	719
2004	1,564,392				

1. Statistics New Zealand June year data for 1989, 1990, 1992, 1993, 1995, 1996, 2002, 2003
 1991 estimate is average of 1990 and 1992
 1994 estimate is average of 1993 and 1995
 1997 to 2001 is interpolated between 1996 and 2002
 Data for 2004 was not processed in time for inclusion in the inventory and is set equal to 2003

2 IPCC default value

Land use change matrix from 1997 to 2002 (based on the LCDB1 and LCDB2 data)

		Land area categories from LCDB1 (1997) (kha)										Total	
		FMp	FMn	CMa	CMp	GMh	GMI	WM	WU	S	O		
LCDB2 2002	FMp	1904.478	10.841	0.007	0.015	90.986	39.611	0.000	0.000	0.000	0.027	0.023	2045.988
	FMn	0.020	8182.228	0.000	0.000	0.281	0.005	0.000	0.000	0.000	0.031	0.033	8182.598
	CMa	0.000	0.003	333.590	0.000	0.119	0.000	0.000	0.000	0.000	0.000	0.006	333.719
	CMp	0.212	0.000	1.363	77.954	4.197	0.000	0.000	0.000	0.000	0.000	0.000	83.726
	GMh	0.132	0.928	0.000	0.000	8883.802	0.903	0.000	0.000	0.000	0.027	0.000	8885.793
	GMI	1.250	2.801	0.000	0.000	0.135	5475.786	0.000	0.000	0.000	0.034	0.213	5480.217
	WM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001
	WU	0.000	0.001	0.000	0.000	0.646	0.019	0.000	531.244	0.038	0.014	0.000	531.960
	S	0.544	0.019	0.000	0.023	5.006	0.026	0.000	0.000	214.844	0.000	0.000	220.462
	O	0.002	0.192	0.000	0.000	0.043	0.018	0.000	0.000	0.000	1056.841	0.000	1057.095
	Total	1906.638	8197.012	334.960	77.992	8985.215	5516.369	0.000	531.244	215.000	1057.129	1057.129	26821.559
Net	139.350	-14.414	-1.241	5.734	-99.422	-36.152	0.001	0.716	5.462	-0.034			

Land use change matrix from 1997 to 1998 (an example showing interpolated annual changes)

		Implied land use changes from 1997 to 1998 (kha)										Total	
		FMp	FMn	CMa	CMp	GMh	GMI	WM	WU	S	O		
1998	FMp	1906.206	2.168	0.001	0.003	18.197	7.922	0.000	0.000	0.000	0.005	0.005	1934.508
	FMn	0.004	8194.055	0.000	0.000	0.056	0.001	0.000	0.000	0.000	0.006	0.007	8194.129
	CMa	0.000	0.001	334.686	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.001	334.712
	CMp	0.042	0.000	0.273	77.984	0.839	0.000	0.000	0.000	0.000	0.000	0.000	79.139
	GMh	0.026	0.186	0.000	0.000	8964.932	0.181	0.000	0.000	0.000	0.005	0.000	8965.330
	GMI	0.250	0.560	0.000	0.000	0.027	5508.252	0.000	0.000	0.000	0.007	0.043	5509.138
	WM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	WU	0.000	0.000	0.000	0.000	0.129	0.004	0.000	531.244	0.008	0.003	0.000	531.387
	S	0.109	0.004	0.000	0.005	1.001	0.005	0.000	0.000	214.969	0.000	0.000	216.093
	O	0.000	0.038	0.000	0.000	0.009	0.004	0.000	0.000	0.000	1057.071	0.000	1057.122
	total	1906.638	8197.012	334.960	77.992	8985.215	5516.369	0.000	531.244	215.000	1057.129	1057.129	26821.559
net	27.870	-2.883	-0.248	1.147	-19.884	-7.230	0.000	0.143	1.092	-0.007			

Land use change matrix from 2003 to 2004 (an example showing extrapolated annual changes for 2003)

		Extrapolated land use changes from 2003 to 2004 (kha)										Total	
		FMp	FMn	CMa	CMp	GMh	GMI	WM	WU	S	O		
2004	FMp	2073.426	2.168	0.001	0.003	18.197	7.922	0.000	0.000	0.000	0.005	0.005	2101.728
	FMn	0.004	8176.758	0.000	0.000	0.056	0.001	0.000	0.000	0.000	0.006	0.007	8176.832
	CMa	0.000	0.001	333.197	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.001	333.222
	CMp	0.042	0.000	0.273	84.865	0.839	0.000	0.000	0.000	0.000	0.000	0.000	86.019
	GMh	0.026	0.186	0.000	0.000	8845.626	0.181	0.000	0.000	0.000	0.005	0.000	8846.024
	GMI	0.250	0.560	0.000	0.000	0.027	5464.870	0.000	0.000	0.000	0.007	0.043	5465.756
	WM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001
	WU	0.000	0.000	0.000	0.000	0.129	0.004	0.000	532.104	0.008	0.003	0.000	532.247
	S	0.109	0.004	0.000	0.005	1.001	0.005	0.000	0.000	221.523	0.000	0.000	222.647
	O	0.000	0.038	0.000	0.000	0.009	0.004	0.000	0.000	0.000	1057.030	0.000	1057.081
	total	2073.858	8179.715	333.471	84.872	8865.908	5472.987	0.001	532.104	221.555	1057.088	1057.088	26821.559