

**REPORT ON THE NATIONAL SITUATION REGARDING THE
IMPACT OF FIRES ON THE FORESTS**

**Barbara Ubysz
Ryszard Szczygieł
Józef Piwnicki**

POLAND, NOVEMBER 2006

CONTENS

1. REPORT ON THE NATIONAL SITUATION REGARDING THE IMPACT OF FIRES ON THE FORESTS	3
1.1. The occurrence of forest and wildland fires in Poland in the period 2005-2006.....	3
1.2. Losses and Damages Caused by Fires	5
TABLES	7
FIGURES	7

1. REPORT ON THE NATIONAL SITUATION REGARDING THE IMPACT OF FIRES ON THE FORESTS

1.1. The occurrence of forest and wildland fires in Poland in the period 2005-2006

Fire situation in the period 2005-2006 was developed primarily under effects of meteorological conditions which caused that 12,803 forest fires and 28,637 wildland fires occurred in Poland in 2005, and 11,207 and 19,213, respectively, in 2006 (i.e. until 10 September 2006). In 2005 the number of forest fires accounted for 183% of the forest fires total of the previous year 2004 (i.e. almost by 6 thousand more according to modernized data) and almost threefold as much as in 2001 when a small number of fires occurred. Their number presented the highest value after 2003 (17,088), exceeding for the fourth time the number of 11 thousand, and for the seventh time that of 10 thousand, and by 66% the 1990 mean (7,698), and by 25% that in the preceding five-year period (2000-2004). In 2006, the number of fires (11,207) was close to that in 2005, thus exceeding 10 thousand for the seventh time (previously in 1992, 1994, 2000, 2002, 2003 and 2005).

The largest number of forest fires (Figure 1) occurred in the Mazovian Province (NUTS^{*}=2) in both 2005 (3,694, i.e. 29%), and 2006 (2,824, i.e. 25%). That means a more than twofold increase when compared to the preceding year. About 1.2 thousand fires occurred in 2006 in the Lubuskie (NUTS=8) (11%) and in 2005 in Łódzkie Provinces (NUTS=10) (9%). Moreover, each of about 700-900 fires occurred in 2005 in the Lubuskie (NUTS=8), Kujawy-Pomeranian (NUTS=4), Silesian (NUTS=24) and Świętokrzyskie (NUTS=26) (7% each), and Wielkopolskie (NUTS=30) (6%) Provinces. The smallest number of fires (1%) occurred in 2006 in the Opolskie (NUTS=16) (136) and Małopolskie (NUTS=12) Provinces (154), and in 2005, in the Opolskie (NUTS=16), Małopolskie (NUTS=12) and Warmian-Masurian (NUTS=28) Provinces (261, 279 and 282).

Figure 2 illustrates distribution of the forest fires occurrences throughout the national territory by Province and months of the forest fire hazard season (1 April – 30 September). In 2005, the central and western regions of Poland were the most "firing" areas during that period, including the Mazovian (NUTS=14) (26%), Łódzkie (NUTS=10) (10.5%), Lubuskie (NUTS=8) (8%), and Kujawy-Pomeranian (NUTS=4) (7.6%) and Silesian (NUTS=24) (7.2%) Provinces. In 2006, more than 21% of the total number of fires occurred in that season in the Mazovian (NUTS=14) Province, including also large numbers in the Lubuskie (NUTS=8) (11.5%), Świętokrzyskie (NUTS=26) (7.7%), and Łódzkie (11%) Provinces. In most Provinces, the peaks of the forest fires occurrences appeared in April and July 2005. In 2006, such peaks appeared in May, in the Małopolskie (NUTS=14) and Warmian-Masurian (NUTS=28) Provinces.

When summed-up throughout Poland, the distribution of the forest fires occurrences in particular months (Figure 3) showed their maximum in July 2006 (5,770, i.e. 51% of total fires *per annum*). In July, more fires occurred than in the period between April and the end of June (5,385). The daily number of fires reached 200 in that time. April 2005 ranked as the second month with the largest number of forest fires (3,311, i.e. 26%), and the subsequent ones in line were July 2005 (2,375, i.e. 19%) and May 2006 (2,130, i.e. 19%). In 2006, a considerable number of fires occurred also in June (16%, i.e. 1,728) and in September 2005 - (14%, i.e. 1,842). The smallest number of fires during the fire season occurred in August 2005 (7%), whereas in February – the lowest as for the whole year (0.1%).

The number of wildland fires in 2005 was almost twofold lower than in the peak year 2003 (53,367), thus ranking as the second in terms of its magnitude (28,637). In 2006, their number dropped to 19,213. The numbers in years 2005 and 2006 accounted for 155% and 104%, respectively, of the multi-year mean for 1994-2006 (18,563).

The largest number of wildland fires in 2005 (Figure 4) occurred in central and south-western part of the national territory, i.e. in the Mazovian (NUTS=14) (5,925, accounting for 21% of the total)

* Code of NUTS (Level 2) for Province

and the Lower-Silesian (NUTS=2) (3,600, accounting for 13% of the total) Provinces, and more than 2 thousand also in the Świętokrzyskie (NUTS=26) (8%) Province. Their smallest number occurred in the Podlaskie (NUTS=20) (321, i.e. 1%), and below 500 also in the Kujawy-Pomeranian (NUTS=4) (1%) Provinces. In 2006 (Figure 4), the largest number of wildland fires occurred in the Mazovian (NUTS=14) – 3,008 (i.e. 16% of the total and almost a half less than in 2005, and almost a half as much than in 2004), and in the Lower-Silesian (NUTS=2) (2 851, i.e. 15%) Provinces. The smallest numbers of fires were noted in the Opolskie (NUTS=16) (231, i.e. 1%), and 329 in the Kujawy-Pomeranian (NUTS=4) (2%) Provinces.

In the period 1994-2006 (Table 1), between about 4.5 thousand and more than 17 thousand forest fires occurred annually. The mean values for the recent 5-year periods (Table 2) speak for their increasing trend.

The numbers of forest fires in the areas managed by the State Forests (4,501) in 2005 and (4,446) in 2006 were closed to that in 1996 and 1999 (4,546 and 4,533), and to the 5-year (2000-2004) mean. Their share in the total national number of fires accounted for 35% (likewise in 2002 – 37%), and in 2006 for 40%.

The fires which break out in non-State owned forest areas has been still prevailing. In 2005, their number amounted to 8,302 that accounts for 94% of fires in 2003. That number was about twofold as much as the multi-year mean, thus accounting for 141% of the 2001-2005 mean (5,904), and 165% of the 1996-2005 mean (5,019). In 2006, the number of fires amounted to 6,761, e.g. little less as the multi-year mean (likewise in 2002).

The total forest area burnt (in the period 1994-2006) amounted from 3.4 thousand ha up-to 28.5 thousand ha, whereas the annual mean was about 8 thousand ha (Table 1). During the recent three 5-year periods (2000-2004, 2001-2005 and 2002-2006 – Table 2), the fires burned out 8-9 thousand ha area (whereas in the earlier periods it was 5.5-5.9 thousand ha), on average. In 2005, forests were burned out in the area total smaller by 9-18% of the aforementioned multi-year means (7,387 ha), including 1,197 ha in the State Forests (29% of that in 2003). In 2006, 7,561 ha forest area was burned out.

The total forest area burnt annually by wildland fires (in analogous period 1994-2006) amounted to between 13 and 96 thousand ha, thus giving 32,729 ha annual mean. In 2005, the area burned out by wildland fires, amounting to 29,074 ha, was close to the multi-year annual mean and to that in 2001 and 2004 (28,509 and 30,626, respectively), and it was more than threefold as much as the value in catastrophic year 2003. In 2006, such area yet further declined to 17,565 ha. Since 1994, that was the second year ranked as the lowest in regard of the total area burnt (ranking second after 1995 with its value of 13,342 ha). That accounted for 18% of the area burned out in 2003 with 95,906 ha area burnt.

The distribution of the fires occurrence by the magnitude of the area burnt is presented in Figures 5 and 6. Among the fires, both in forest and wildland areas, small fires were prevailing, i.e. ≤ 1 ha. Small forest fires accounted for 89%. Medium fires (1-10 ha) occurred in 11% in 2005 and 10% in 2006. Large size fires were 26 and 53, respectively, i.e. below 1%. No fires occurred which would be considered very large ones (> 100 ha).

Among wildland fires, 80% and 83% of small fires occurred in 2005 and 2006, respectively. The share of large size fires in 2006 declined only by 3% (from 19 to 16%) in relation to that of 2005, whereas they declined considerably in terms of their number, (almost by 2.5 thousand). In 2005, 112 large size fires occurred, and 71 in 2006, and very large ones were – 2 (2005) and 1 (2006). Comparison of the mean values for the recent two 5-year periods (1996-2000 and 2001-2005) as regards forest fires and wildland fires (Table 1) indicates a clear increase in terms of their both number (for their total by 75%) and the area burnt (by 26%). The numbers of forest fires, in both 2005 and 2006 was larger than those in the recent two 5-year periods (Table 1). They increased by

83% (2005) and 60% (2006) when compared to that of 2004. The number of wildland fires in 2005 was larger than that in the recent 5-year period, and twofold as much than in the preceding period. In 2006, it dropped and has accounted for 67 and 68% of the 2005 value and that in recent 5-year period, respectively. The area burnt by forest fires in 2005 and 2006 (7,387 and 7,561 ha) was close to that of 1993 value (7,341 ha) and slightly lower than the recent two periods (8,011 and 9,749 ha, respectively). The area burnt by wildland fires in 2005 (29,074 ha) was close to that of both the first 5-year period and 2004, whereas in 2006 (17,565 ha) it was apparently lower when compared to the both 5-year periods (i.e. 32,990 ha and 42,082 ha), thus accounting for 60% of the 2005 magnitude.

The share of forest areas affected in 2005 by fires in those managed by the State Forests, amongst the total areas burnt domestically, dropped to 17% (the minimum amounted so far to 19% in 2003), and in 2006 it increased again up to 40% which accounted for the 2000 level (i.e. 41%).

The mean area of single fire in forests, by all ownership types, diminished almost twofold in 2005 (to 0.55 ha) and in 2006 (to 0.67 ha) when compared to that of 2003 and was similar to that in 2000 and 2001 (0.59 and 0.74 ha, respectively), and in the 5-year period 1998-2002 (0.66 ha). In the State Forests, it reached value 0.27 ha in 2005 and 2006, and was the lowest one ever noted being close to that in 2004 (0.29 ha). In non-State owned forests it amounted to 0.75 ha in 2005 (while ranking as third among the lowest values noted from 1991), and it amounted to 0.94 ha in 2006.

Notwithstanding the meteorological circumstances, also (while being still large) the number of fires in other wildland (wasteland) areas significantly contributed to the number of the forest fire occurrences. However, the fact is noteworthy that the most considerable decline in idle land and waste land areas followed in 2002 and 2003 in land used for agricultural purpose (from 2.302 million to 1.305 million ha). Thus, that fact had apparent effects also on the frequency of fires occurring there, hence also on their hazard to forests.

In 2005-2006, intentional arsons were the predominating cause for fires (Figures 7 and 8) in both forest and wildland areas, and they amounted to more than 53 and 48% (in forest areas), and 24 and 48% (in wildland areas). Either type of anthropogenic negligence (carelessness) ranked as the second as the cause for fires, in terms of their magnitude, that contributed to forest fires in 39% (2005) and 43% (2006), and to wildland fires in 68% (2005) and 43% (2006). Carelessness in open fire use was the most significant among such incidents (33-35%). Natural causes, i.e. atmospheric discharges were the cause for forest fires in only 0.3% of the incidents, and yet less for wildland area fires ($\leq 0.1\%$). Non-identified causes accounted for the level of 7-9%.

1.2. Losses and Damage Caused by Fires

The magnitude of losses caused by fires in particular years of the 1994–2006 period is shown in Table 3. The total losses presented there amount to about 507 million PLN (130 million €¹) during the period under analysis. These losses are clearly differentiated and they range between 45 million PLN (11.6 million €) in 2001 and 197 million PLN (51 million €) in 2003. The losses in 2005 were larger than their multi-year means and amounted to 104 million PLN (26.7 million €), and in 2006 were below their multi-year mean - 57 million (14.7 million €). In case of forest fires, the losses include the value of the stands burned out, whereas those in waste land are referred to soil.

The average value of 1 ha forest area as calculated in Poland is 31,357 PLN (8,055 €). The original values of (high) forests only in the area affected by fires in 2005 and 2006 were 232 million PLN (60 million €) and 237 million PLN (61 million €), respectively. The values of direct losses in those forests are estimated at 52 million PLN (13.4 million €) and 36 million PLN (9.3 million €), that accounted for 23% and 15% of their original values, respectively. Additionally, the values of losses in wildland areas in the same time-period are estimated at 52 million PLN (13.2 million €) and 21 million (5.4 million €), respectively.

¹ 1 € = 3.8930 PLN

Given the quantity of vegetation biomass per area unit that was burned out in forest and wildland areas, the quantity of carbon dioxide (CO₂) was calculated which was released during fires. The types of fires and the quantities of vegetation biomass burned out were considered, while assuming 82 tonnes/ha (soil cover fire, and sub-cover fire) and 94 tonnes/ha (total fire), and 55 tonnes/ha for wildland areas. The details are compiled in Table 4. These values vary depending upon year. The total carbon mass released in result of fires in the period between 1994 and 2006 was 44.5 million tonnes CO₂ (from 1.58 million tonnes in 1995 to 10.47 million tonnes in 2003). During years 2005 and 2006 the totals amounting to 2.73 and 3.02 million tonnes CO₂ were released which accounted for the quantities close to the multi-year means (3.42 million tonnes). Moreover, the emission totalling to about 492 thousand tonnes carbon dioxide, 188 thousand tonnes solid and liquid particles (fumes), 47 thousand tonnes hydrocarbons, and also about 9 thousand tonnes nitrogen oxides were emitted into the atmosphere.

TABLES
Table 1. Wildfire database for Poland in the period 1994-2006*

Year	Number of Fires of			Burned Area [ha] of			Average Area [ha] of Fire of		
	Forest	Wildland	Forest and Wildland	Forest	Wildland	Forest and Wildland	Forest	Wildland	Forest and Wildland
1994	10,710	5,167	15,877	9,171	19,215	28,386	0.86	3.72	1.79
1995	7,681	5,733	13,414	5,306	13,342	18,648	0.69	2.33	1.39
1996	7,924	11,883	19,807	14,120	44,808	58,928	1.78	3.77	2.98
1997	6,818	12,486	19,304	6,598	41,832	48,430	0.97	3.35	2.51
1998	6,166	11,545	17,711	4,019	26,561	30,580	0.65	2.30	1.73
1999	9,820	16,015	25,835	8,307	27,484	35,791	0.85	1.72	1.39
2000	12,428	16,024	28,452	7,013	24,264	31,277	0.56	1.51	1.10
2001	4,480	16,167	20,647	3,429	28,509	31,938	0.77	1.76	1.55
2002	10,101	22,537	32,638	5,593	26,293	31,886	0.55	1.17	0.98
2003	17,088	53,367	70,455	28,554	95,906	124,460	1.67	1.80	1.77
2004	7,006	22,543	29,549	3,781	30,626	34,407	0.54	1.36	1.16
2005	12,803	28,637	41,440	7,387	29,074	36,461	0.58	1.02	0.88
2006	11,207	19,213	30,420	7,561	17,565	25,126	0.67	0.91	0.83
Year Average									
1996-2000	8,631	13,591	22,222	8,011	32,990	41,001	0.93	2.43	1.85
2001-2005	10,296	28,650	38,946	9,749	42,082	51,830	0.95	1.47	1.33

*) Data of 2006 till 10 September

Table 2. Statistical data of fires in high forest in Poland in the period 1981-2006

Period	Year Average of							Percentage Share of Fires in SF* in the Total Levels in Poland in Respect to	
	No. of Forest Fires		Burned Area [ha]		Area of Fire [ha]				
	Total	into SF	Total	into SF	Total	into SF	Other	No. of Fires	Burned Area
The Five-Year-Periods									
1981-1985	2,799	2,627	4,469	3,871	1.60	1.47	3.49	94	87
1986-1990	3,419	3,001	4,389	3,603	1.28	1.20	1.88	88	82
1991-1995	8,364	5,206	13,818	8,673	1.65	1.67	1.63	62	63
1996-2000	8,366	4,232	8,011	2,500	0.96	0.59	1.37	51	31
The Last Five-Year-Periods									
1997-2001	7,757	3,732	5,854	1,574	0.75	0.42	1.06	48	27
1998-2002	8,472	3,759	5,551	1,376	0.66	0.37	0.89	44	25
1999-2003	10,700	4,720	9,047	1,923	0.85	0.41	1.19	44	21
2000-2004	10,221	4,502	8,142	1,762	0.80	0.39	1.12	44	22
2001-2005	10,296	4,392	8,217	1,648	0.80	0.38	1.11	43	20
2002-2006	11,641	4,872	9,062	1,755	0.78	0.36	1.08	42	19
The Ten-Year-Periods									
1981-1990	3,109	2,814	4,429	3,737	1.42	1.33	2.35	91	84
1989-1998	7,110	4,584	10,616	6,242	1.49	1.36	1.73	64	59
1990-1999	7,698	4,628	10,947	5,913	1.42	1.28	1.64	60	54
1991-2000	8,365	4,719	10,915	5,587	1.30	1.18	1.46	56	51
The Last Ten-Year-Periods									
1992-2001	8,460	4,623	10,991	5,444	1.30	1.18	1.45	55	50
1993-2002	8,284	4,068	7,124	2,229	0.86	0.55	1.16	49	31
1994-2003	9,111	4,447	8,445	2,279	0.93	0.51	1.32	49	27
1995-2004	8,809	4,276	7,962	2,129	0.90	0.50	1.29	49	27
1996-2005	9,331	4,312	8,114	2,074	0.87	0.48	1.20	46	26
1997-2006	9,699	4,302	7,458	1,665	0.77	0.39	1.07	44	22

*) SF – States Forests

Table 3. Losses caused by forest and wildland fires in the period 1994-2006 in thousand PLN

Year / Period / Year Average	Losses [thousand PLN] Caused by Fires of		
	Forest	Wildland	Forest and Wildland
1994	37373	19,576	56,949
1995	28,327	17,807	46,134
1996	57,649	45,735	103,384
1997	34,934	55,372	90,306
1998	22,744	37,578	60,322
1999	48,110	39,794	87,904
2000	34,152	29,540	63,692
2001	14,517	30,174	44,691
2002	20,766	24,406	45,172
2003	106,900	89,763	196,663
2004	13,256	26,844	40,100
2005	52,352	51,512	103,864
2006	36,164	21,003	57,167
1994-2006	507,244	489,104	996,348
1996-2000	197,589	208,019	405,608
2001-2005	207,791	222,669	430,490
Year Average			
1996-2000	39,518	41,604	81,122
2001-2005	41,558	44,540	86,098

Table 4. The quantities of CO₂ [thousand PLN] emitted as result of forest and wildland fires in the period 1994-2006

Year / Period / Year Average	Quantities CO ₂ [thousand PLN] Emitted as Result Fires of		
	Forest	Wildland	Forest and Wildland
1994	1,016	1,453	2,469
1995	574	1,009	1,583
1996	1,547	3,387	4,934
1997	724	3,162	3,886
1998	440	2,008	2,448
1999	939	2,078	3,017
2000	784	1,834	2,618
2001	383	2,155	2,538
2002	625	1,988	2,613
2003	3,216	7,250	10,466
2004	419	2,315	2,734
2005	819	2,198	3,017
2006	838	1,328	2,166
1994-2006	12,324	32,165	44,489
Year Average	948	2,474	3,422
1996-2000	4,434	12,469	16,903
Year Average	887	2,494	3,381
2001-2005	5,462	15,906	21,368
Year Average	1,092	3,181	4,274

FIGURES

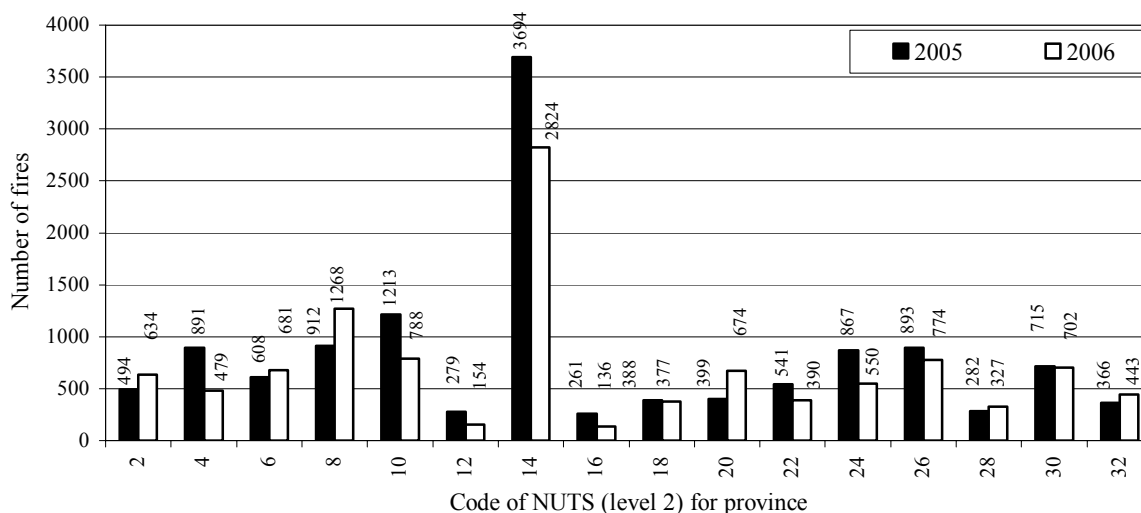


Fig. 1. Distribution of number of forest fires by province (code of NUTS on level 2) in 2005 and 2006 in Poland

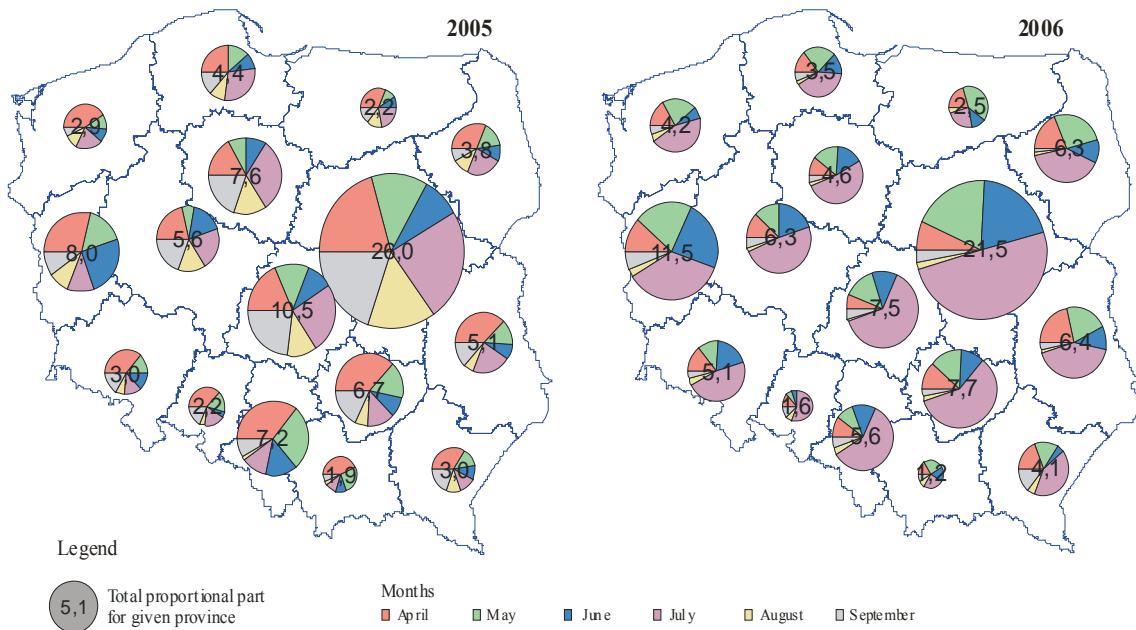


Fig. 2. Proportional distribution of number of forest fires by province and months in fire periods (i.e. 1 April – 30 September) in Poland

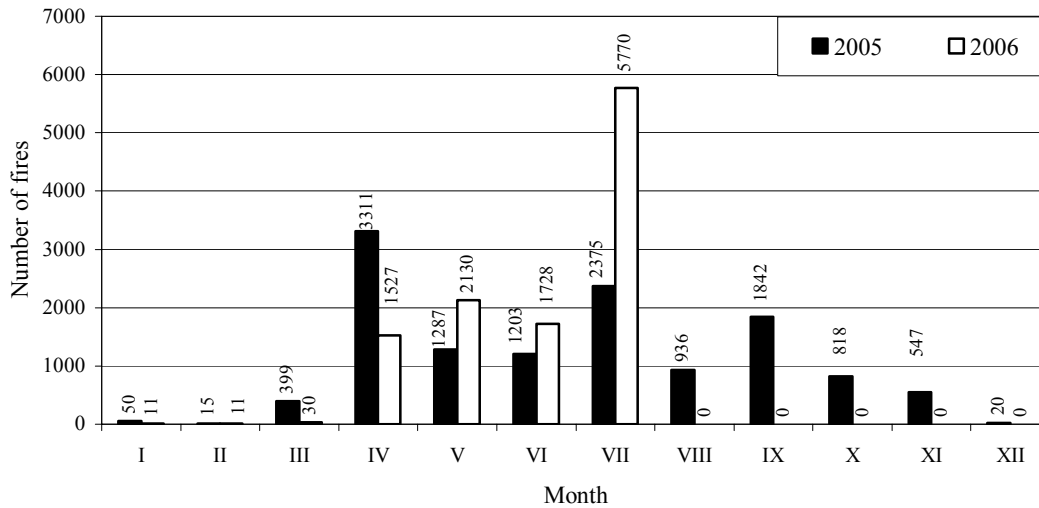


Fig. 3. Distribution of number of forest fires by months in 2005 and 2006 in Poland

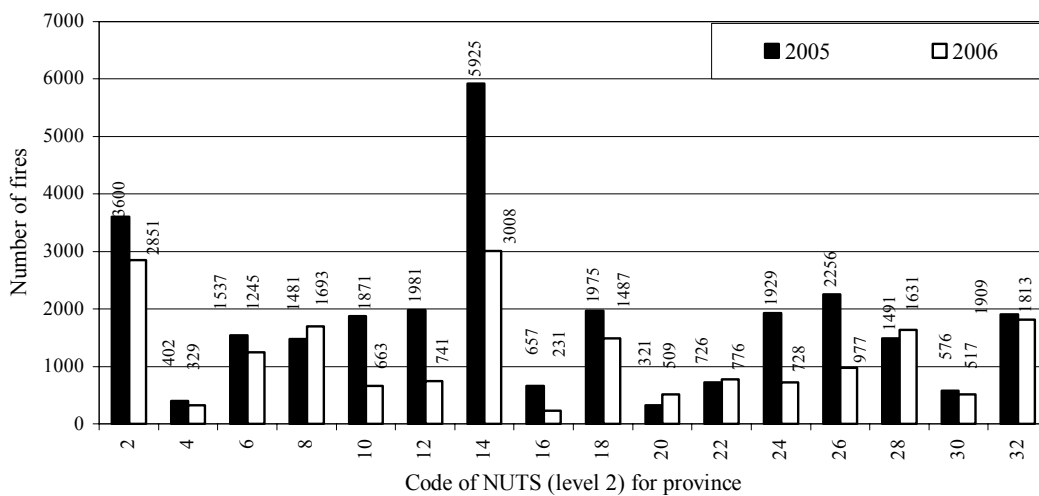


Fig. 4. Distribution of number of wildlands fires by province (code of NUTS on Level 2) in 2005 and 2006 in Poland

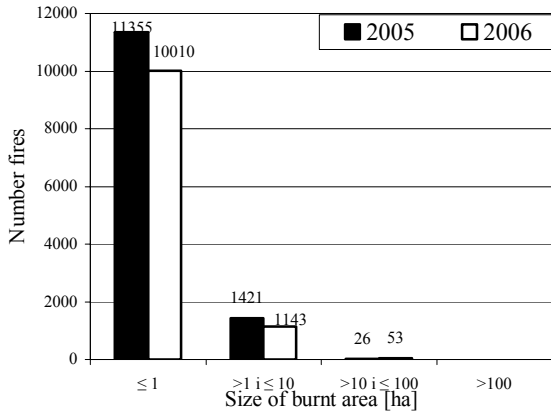


Fig. 5. Distribution of number of forest fires by size of burnt area in year 2005 and 2006 in Poland

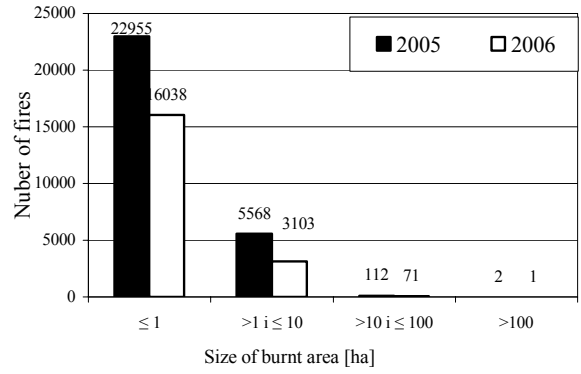


Fig. 6. Distribution of number of wildland fires by size of burnt area in 2005 and 2006 in Poland

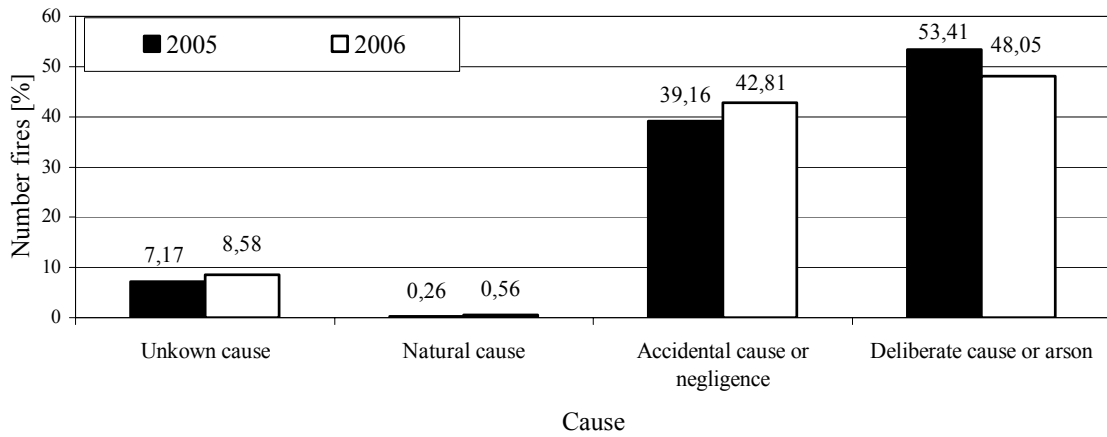


Fig. 7. Distribution of number of forest fires by causes in 2005 and 2006 in Poland

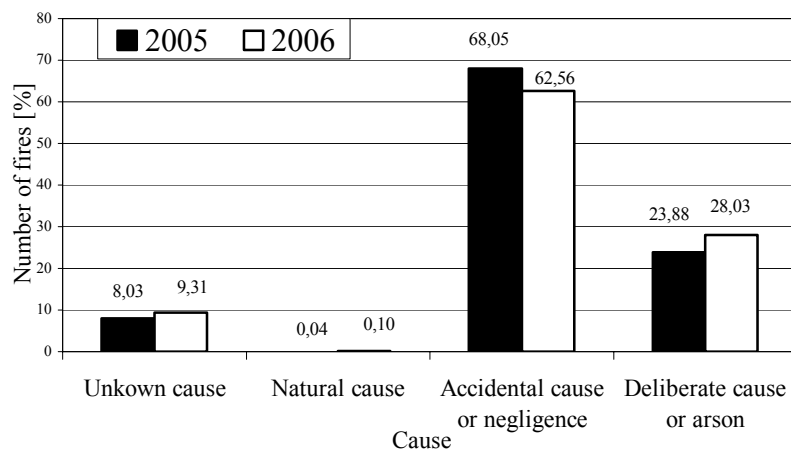


Fig. 8. Distribution of number of wildlands fires by causes in year 2005 and 2006 in Poland (state on day 10.09.2006)

