

# **REPORT ON STORM DAMAGES IN SLOVAKIA**

By the Ministry of Agriculture of Slovakia  
as of 27 January 2005

## **Impacts of windthrow disaster on forest ecosystems in Slovakia**

On 19 November 2004 between 03:00 p.m. and 08:00 p.m., the territory of the Slovak Republic was hit by whirlwind with the biggest adverse effect on forest ecosystems in the regions of the upper flow of the Hron-river (districts of Brezno, Banská Bystrica, Zvolen), the region of Kysuce (districts of Čadca, Kysucké Nové Mesto), the region of Orava (districts of Námestovo, Tvrdošín), the region of Spiš (districts of Spišská Nová Ves, Gelnica, Levoča, Rožňava) and that of the Tatra Mountains (districts of Poprad, Kežmarok, Liptovský Mikuláš, Stará Ľubovňa, especially the forest land resources on the territory of the Tatra National Park - TANAP). Force of wind in gusts attained the speed of almost 200 km/h. Windstorm left behind calamity affecting forests on the territory with the total area of 330 thousand hectares. The total volume of wood of broken or windthrown trees hit by the calamity represents the volume of approximately 4.7 million m<sup>3</sup> of wood. 3.75 million m<sup>3</sup> were destroyed on forest lands in state ownership, while the extent of calamity in forests not owned by the state represents 0.95 million m<sup>3</sup>.

On the territory of the TANAP (Tatra National Park), 12 thousand ha of forest ecosystems were hit by the calamity, while the volume of windthrown timber is approximately 2.5 million m<sup>3</sup>. Within the competence of the Ministry of Agriculture of the Slovak Republic and organizations established and founded by the Ministry, there were taken measures to carry out works with participation of the owners, administrators and users of affected forests. 34 million SKK were expended on security works both in governmental as well as non-governmental forest sector, while 10 million SKK were released from the state budget for ŠL TANAP (State Forests of the Tatra National Park).

There were started preparatory works on schedules of processing the windthrown timber and plans of revitalization of territories devastated by calamity as well as on plans of forest protection. In addition to users of forests, participants in these works are also the Technical University in Zvolen, Forest Research Institute Zvolen, Lesoprojekt Zvolen, bodies and organizations within the competence of the Ministry of the Environment of the Slovak Republic as well as representatives of self-governments affected. In relation to occurrence of extraordinary events in forests, increased demands are being put also on authorities of state administration of forestry and game management, which secure the implementation of the measures of the Ministry of Agriculture to cope with the situation on affected territories.

## **Introduction**

Between the high-pressure area over the south-western part of the Continent and lower pressure over the North of Europe, a frontal system was proceeding across Scandinavia and the Baltic Sea to the East on Thursday of 18 November 2004. As a consequence of a big temperature difference between cold Arctic air in the North and warm air in the South of the cold front, the depression was distinctly deepened, while the pressure difference on the frontal system was increasing, which is the major cause of air streaming. Passage of cold front across the territory of Slovakia was accompanied by distinct weather changes, e.g. change in wind direction to north-western one and its strengthening, strong decrease and subsequently abrupt increase of pressure, swift decrease of temperature behind the front. With a stronger wind, the difference becomes more distinct between average speed

of wind and its gusts whose velocity is considerably higher than the average speed. On 19 November at about 02:00 p.m., the strongest gusts of wind were recorded in the area of Bratislava, Nitra, Piešťany, where the speed of gusts reached 104 - 115 km/h. In the area of the High Tatra Mts., the strongest gusts were within the period of time from 04:00 p.m. to 07:00 p.m., achieving the speed from 160 to 194 km/h, while the highest gusts were measured at the mountain lake of Skalnaté pleso (194 km/h) as well as on the peak of Lomnický štít (166 km/h), out of which it follows that the falling wind was prevailing at the critical period of time, due to which calamity hit primarily leeward slopes of the High Tatra and the Low Tatra Mts. The average speed of wind exceeding 118 km/h is considered hurricane, whereas such weather condition occurs in the basin of Popradská kotlina approximately once in 50 years. The maximum speed of wind reached 123 km/h, while in Telgárt in the upper flow of the Hron-river 140 km/h, i.e. velocity of wind surpassed this limit in the lower situated territories too. Strong wind was locally associated with strong vortices. Position of windthrown trees in the direction against the wind proved of that.

## **1. Impacts of natural disaster on forest ecosystems on the territory of TANAP (Tatra National Park)**

Based on findings as of 2 December 2004, the stands hit by wind calamity of 19 November 2004 are located on the area of approximately 12 thousand hectares. On this area approximately 57% of damaged forest ecosystems are in the ownership of the government, while the rest is in private ownership, whereas the town of Kežmarok, ZBU Východná, ZBU Štrba, the town of Spišská Belá and ZBU Gerlachov were affected the most.

The affected territory was not exclusively covered with spruce monocultures and it may be stated that static and ecological stability of forest stands with the strength of wind of about 200 km/h, did not play main role in protection against the effects of abiotic factors, of what proves also the fact on the affected territory there were damaged also forest stands that were considered stable according to evaluation criteria and, vice versa, many of them considered instable resisted the effects of whirlwind.

### **1.1. Specification of the volume of windthrown timber on the territory of the Tatra National Park (TANAP)**

Windthrow disaster damaged forest stands in protective districts of Podbanské, Štrbské pleso, Vyšné Hágy, Dolný Smokovec, Tatranská Lomnica and Kežmarské Žľaby. Total estimated volume of windthrown timber is about 2,059 thousand m<sup>3</sup> (Chart No. 1). From the perspective of further advancement of timber processing and respecting the preservation of nature protection, it is important to specify the proportion of calamity volume in the 3<sup>rd</sup> degree of nature protection (approximately 70% of the total volume) and in the 5<sup>th</sup> degree (approximately 30% of the total volume) of nature protection.

Protection district	Windthrow n timber in the 3 <sup>rd</sup> protection degree (m <sup>3</sup> )	Windthrow n timber in the 5 <sup>th</sup> protection degree (m <sup>3</sup> )	Concentrated calamity		Scattered calamity		Calamity in total (m <sup>3</sup> )
			Windthrows (m <sup>3</sup> )	Fractures (m <sup>3</sup> )	Windthrows (m <sup>3</sup> )	Fractures (m <sup>3</sup> )	
Podbanské	26250	57751	48694	20869	9188	5250	84001
Štrbské pleso	73613	68447	78779	34870	18726	9685	142060
Vyšné Hágy	373806	166775	374956	111567	42556	11502	540581
Dolný Smokovec	706728	77024	397281	351338	28377	6756	783752
Tatranská Lomnica	334935	167468	172870	259305	34574	35654	502403
Kežmarské Žľaby	234840	167433	204398	146775	31530	19570	402273
<b>State-owned forests of TANAP</b>	1750173	704897	1276978	924724	164951	88417	2455070

From perspective of damage to stands according to the age, mostly damaged were the stands at the age 61 – 80 years (approximately 28.5%), followed by the stands 81 – 100 years old (approximately 23%) and stands 101 – 120 years old (21.8%). Upon quantifying the assumed volume of windthrown timber according to tree species, spruce accounts for the highest proportion (approximately 81.5%), while other species have a distinctly lower proportion (pine about 8.8%, larch approximately 7%, fir approximately 1.5%, and a small proportion of birch and alder).

Based on reports of non-governmental entities submitted to district forest offices in Poprad and Kežmarok, there is a lot of windthrown timber of non-governmental entities in the districts of Liptovský Mikuláš (approximately 7 thousand m<sup>3</sup>), Kežmarok (estimated volume of about 20 thousand m<sup>3</sup>) and Poprad with approximately 410 thousand m<sup>3</sup>. Windthrow disaster affected non-governmental entities most of all in municipalities of Východná (approximately 35 thousand m<sup>3</sup>), Važec (approximately 20 thousand m<sup>3</sup>), Tatranská Štrba (approximately 50 thousand m<sup>3</sup>), Mengusovce (approximately 30 thousand m<sup>3</sup>), Batizovce + Štôla (approximately 90 thousand m<sup>3</sup>), Gerlachov (approximately 100 thousand m<sup>3</sup>) and Spišská Belá (100,000 m<sup>3</sup>).

From the perspective of damage intensity currently it is estimated that stands on approximately 73% of the total area are in a condition of complete disintegration (of which about 59% are in the ownership of the government), while about 27% (of which about 57% in the ownership of the government) are in a condition of sporadic occurrence of windthrow („Positional map after the wind calamity at LHC of the High Tatra Mts.“).

## 1.2 Time schedule of windthrown timber processing

The time schedule of windthrown timber processing is a basic document solving logistics of disaster removal from the time as well as technology point of view respecting the environmental and economic aspects. Precise quantification of storm disaster impact requires utilization of remote sensing and aerial photography.

The time schedule has been developed by the State Forests of the Tatra National Park with a direct participation of the professional forest public (Technical University in

Zvolen, Forest Research Institute Zvolen, Lesoprojekt Zvolen) and representatives of nature and landscape protection (State Nature Protection) and High Tatras town.

**Principles** for selection of technology for processing of windthrown timber and preference of separate localities from the point of view of minimizing negative impacts of disaster result from respecting the **environmental aspects**

- proposing and implementation of measures are based on the current legal status of the protected territories (3rd and 5th degree of nature and landscape protection based on the Act No. 543/2002 of Collection of Laws);
- respecting the degree of locality nature protection included in the NATURA 2000 network;
- measures and their implementation should be ensured in compliance with a decision of the relevant body of state administration of the environment;
- special attention should be paid at waterlogged areas specified by the State Nature Protection;
- measures for preventing floods should be implemented preferentially – removal of windthrown timber from streambeds of small water courses.

#### **and economic aspects**

- windthrown timber in mature stands, where exists an assumption of maximum wood realization, should be processed preferentially. Within them it is necessary to prefer the stands which are the part of gene bases aimed at obtaining the seed stock in harmony with the Act No. 217/2004 of Collection of Laws where exists the assumption to gain the seed material;
- to prefer the processing of windthrows from the point of view of saw logs production;
- to prefer production of whole-stem logs;
- utilization of harvester technology and integrated cable systems especially on the localities with prevailing soil-protection functions and within the range of existing road network;
- to apply to a maximum extent the integrated cable systems (cableways – processor, within applying the whole-tree logging also a chipper);
- in justified cases (ravines, small water courses and inaccessible localities) utilization of skidding by aerial technology.

### **1.3 Starting points for the restoration and revitalization of forests in the Tatra National Park (TANAP)**

As a result of the calamity on 19 November 2004, an estimated obligation to reforest the area of approximately 12,000 hectares has arisen, of which 8,305 hectares in use of the State Forests of the Tatra National Park (ŠL TANAP) and 3,695 hectares in the ownership of non-governmental entities.

Based on the contemporary condition of damaged forest stands, establishment of new forest stands is assumed on the area of approximately 12,000 ha. Stocks of seeds are not available in required structure of kinds in order to restore forest stands on concentrated calamity areas of TANAP. Therefore it will be necessary to solve this issue by supplementing seed resources by certified seed sources from windthrown trees, especially those of larch and pine.

Cultivation of angiosperm plants in the extent of 20% of the total need is assumed in order to provide for sufficient amount of planting stock to perform reforestation during whole vegetation period. In order to exclude spreading of undesirable gene pool in forest stands of TANAP, it is necessary to enhance inspection activities of the Center of Forestry Seed Control of the Forest Research Institute Zvolen in Liptovský Hrádok. Direct expenses

to reforest areas affected by windthrow disaster on 19 November 2004 in the TANAP are estimated to attain the volume of 150 to 180 thousand SKK/ha.

The above-mentioned facts will be specified in a Project of reconstruction, revitalization and restoration of damaged forest ecosystems. A draft of the project shall be elaborated under direction and coordination of the Forest Research Institute Zvolen with the participation of the representatives of the Technical University in Zvolen, State Forests of the Tatra National Park (TANAP), authorities of TANAP and Lesoprojekt Zvolen on the assumed term of 15 December 2004.

### **1.3.1 Protection of forest**

In each decennium from 1966 to 1976, the State Forests of TANAP processed about 0.5 million m<sup>3</sup> of wood due to negative effect of abiotic and biotic injurious agents. In the period of 1977 – 2003, this limit was exceeded as well. As a consequence of applying restrictions following from applying provisions of the Act No. 543/2004 of the Collection of Laws on Protection of Nature and Landscape in relation to necessity to process windthrown timber (especially spruce in the 5<sup>th</sup> degree of nature protection), 213 thousand m<sup>3</sup> of windthrown timber had been registered before the present calamity situation occurred, of which 143 thousand m<sup>3</sup> of wood were infested with bark beetles what is 67% of the total volume. Based on requirements of the State Forests of the Tatra National Park (ŠL TANAP) submitted to respective bodies of nature protection, there was required in the 5<sup>th</sup> degree of nature protection to take measures for processing the windthrown timber and prevention of an outbreak of bark beetles (felling, skidding, sanitation, leaving stumps, leaving without any intervention) in the extent of 94 thousand m<sup>3</sup> of wood. In relation to this volume it was permitted by a legal decision to take measures only in a part of the required territory in the amount of 25 thousand m<sup>3</sup> of windthrown timber, what represents about 27%.

As it follows from the aforesaid, there is very high abundance of bark beetles population in the area of the TANAP that is at present evaluated as a calamity situation from the viewpoint of forestry. It is assumed that bark beetles will attack preferably windthrown timber in the first swarming of 2005. Their population will develop without any restrictions, as fallen trees cannot develop their natural protective mechanism. Development of the second generation in the windthrown timber will be proceeding only partially, as conductive tissue of trees will desiccate, hence losing its attractiveness for bark beetles. Partially in 2005 and especially in 2006, as much as approximately 90% of population will concentrate on forest stands that are in direct contact with stands affected by calamity. On assumption that in 2005 cold and rainy weather will prevail, an increase of bark beetles outbreak can be expected in the surrounding stands in the volume of about 300 thousand m<sup>3</sup> already in the same year after the second swarming. It is an area of approximately 1,500 hectares of forest. In 2006, when there is an assumption that as much as 90% of population of bark beetles will invade the stands, an increase of calamity is estimated to reach 1 – 1.5 million m<sup>3</sup>, what is about 5 to 7 thousand hectares of forest. In following years, abundance of population will grow in geometric progression (for comparison – in the Šumava mountain region, where a wind calamity hit 1.5 million m<sup>3</sup>, within 3 years there were registered 7 million m<sup>3</sup> of new calamity caused by bark beetles due to its incomplete processing).

With regard to the mentioned facts, it is not recommended to use passive protection in calamity conditions, i.e. without any intervention. It is necessary to consider individual application of partial passive protection or leaving parts of windthrown timber without any intervention. However, the present calamity conditions unambiguously require applying the principles of differentiated active protection of forest that considers ecological principles. These principles consist in using pheromone traps, classic traps and wood sanitation.

Details of minimizing the risks of subsequent bark beetles outbreak, protection of surrounding stands will be particularly addressed in the draft of the Project of Protection of Forest Ecosystems that will be elaborated by a working group under direction and

coordination of the Forest Research Institute Zvolen - Forest Protection Service with the participation of specialists from the Technical University in Zvolen, State Forests of the Tatra National Park, authorities of TANAP. Frameworks of principles of forest protection will be specified by 6 December 2004.

A great emphasis will be put on monitoring the development of pests in the areas affected by the windthrow disaster as well as subsequent measures in case of emergency of unforeseen events. In addition to local forest managers, these activities will be covered by the specialists from the Forest Research Institute – Forest Protection Service as well as specialists from the State Forests of the Tatra National Park (ŠL TANAP).

#### **1.4 Solving the consequences of wind calamity from perspective of land arrangements**

The territory affected by the wind calamity is a potential source of threat in the territory located within micro catchments basins of left-side influents of the Poprad-river and, from the perspective of comprehensiveness of the solution, also in the cadastral territory of Lučivná.

In the above-mentioned microbasins, in forest districts, being affected the most by windthrow disaster, Vyšné Hágy, Dolný Smokovec, Tatranská Lomnica, Kežmarské Žľaby and partially also Štrbské pleso and Podbanské, a marked reduction of forest coverage has resulted. A change of the regime of snow melting on not shaded continual slopes and felling of windthrown timber as well as subsequently a change of roughness and absorbing capacity of the surface may result in a serious endangerment of the territory by local floods. Potentially endangered areas are defined as microbasins with altered forest coverage of the left-sided tributaries of the Poprad-river down to their estuary into the Poprad-river.

Due to the above mentioned reasons it is necessary within competence of the Ministry of Agriculture of the Slovak Republic following:

- Speed up works on performing measures on the territories hit by wind calamity and potentially endangered territories from the viewpoint of restoring their former functions.
- Investigate options of performing land arrangements and if necessary to impose land arrangements on the territories of the municipality Vysoké Tatry and cadastral territories of Stráne pod Tatrami and Rakúsy (with an option of funding from EU funds).
- Carry out amendments in methodological securing of land-arrangement projects being under preparation that lead to speeding up of the works on executing the measures.
- Ensure attaining a socially acceptable deadline of addressing restoration of land registry in the High Tatra Mts.

#### **1.5 Foreign assistance**

In relation to the calamity on the territory of the Tatra National Park (TANAP), there was offered a foreign financial assistance at an amount of 50,000 USD from the UNO Office for Co-ordination of Humanitarian Aid for rescue material.

Technical, advisory and consultancy activities were offered by FAO, the Czech Republic, Croatia, Great Britain, Switzerland, France, Austria as well as the European Economic Committee of UNO. The Austrian party offered assistance in the area of processing and selling wood.

## **2. Impacts of natural disaster on forest ecosystems on other territory of the Slovak Republic**

In the afternoon on 19 November 2004, the whirlwind with a speed to 190 km/h caused damages on forest stands under use of the state enterprise Forests of the Slovak

Republic, Banská Bystrica. This natural disaster left damages in the forests on the whole territory of Slovakia. Of 26 branch forest enterprises, the damages of forest stands were recorded in 23 of them. The most affected branch enterprises were: Beňuš, Námestovo, Čierny Balog, Liptovský Hrádok, less Revúca and Kriváň. The survey of a disaster status total were performed on the basis of the data from the Forest Management Plans, direct findings in the field and qualified estimation by a professional forestry staff.

## **2.1 Specification of calamity extent on the territory except to the Tatra National Park**

On the territory of Slovakia, excluding the region of the Tatra National Park, the total extent of calamity is in volume of 2.5 million cubic meters.

From the given amount, the state enterprise Forests of SR, Banská Bystrica counts 1300 thousand cubic meters, other subjects using the state forests approximately 390 thousand cubic meter. Damages caused by whirlwind in the non-state subjects reached the value approximately 515 thousand cubic meters.

The biggest extent of calamity except to the territory of the Tatra National Park was in the competence of the District Forest Office (DFO) Brezno where were recorded 975 thousand cubic meters, of those 745 thousand cubic meters in the state sector and 230 thousand cubic meters in the non-state sector. Within DFO Poprad there were 439 thousand cubic meters, of those 416 thousand cubic meters in the state sector and 23 thousand cubic meters in the non-state sector. Within DFO Dolný Kubín 200 thousand cubic meters, of those 150 thousand cubic meters in use of the state organizations and 50 thousand cubic meters in the non-state forests. Within the competence of DFO Liptovský Mikuláš there were recorded 130 thousand cubic meters, of those 70 thousand cubic meters in the state sector and 60 thousand cubic meters in the non-state sector.

The most affected area except to the territory of the Tatra National Park was the county of Banská Bystrica with volume of calamity approximately 1110 thousand cubic meters. The most affected organizations within the competence of the state enterprise Forests of SR Banská Bystrica were the Branch Enterprise (BE) Beňuš, where the estimated volume of calamity was approximately 500 thousand cubic meters, BE Námestovo with 192 thousand cubic meters, BE Čierny Balog with 185 thousand cubic meters and BE Liptovský Hrádok with 120 thousand cubic meters of windthrown timber. Within the non-state sector, the highest extent of calamity was in the Municipal Forests Brezno where is recorded approximately 200 thousand cubic meters.

The areas damaged by whirlwind are located mostly out of the territory with the 5th degree of nature protection according to the Act No. 543/2002 of Collection of Laws on Nature and Landscape Protection.

Despite the given facts, the proposed general process intended for solution of calamity situation in the Tatra National Park should be applied also in the case of other territory affected by whirlwind.