



MANFRED
Management strategies to adapt
Alpine Space forests
to climate change risk

Second level analysis on extreme events:
windthrow Jelovica and Črnivec,
fire Šumka

SLOVENIA

Authors of the report

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Management strategies to adapt
Alpine Space forests
to climate change risk

**Second level analysis on extreme windthrows, snow
damages and abiotic occurrences**

SLOVENIA – windthrow Črnivec

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Picture No1.: Windthrow on Črnivec pass

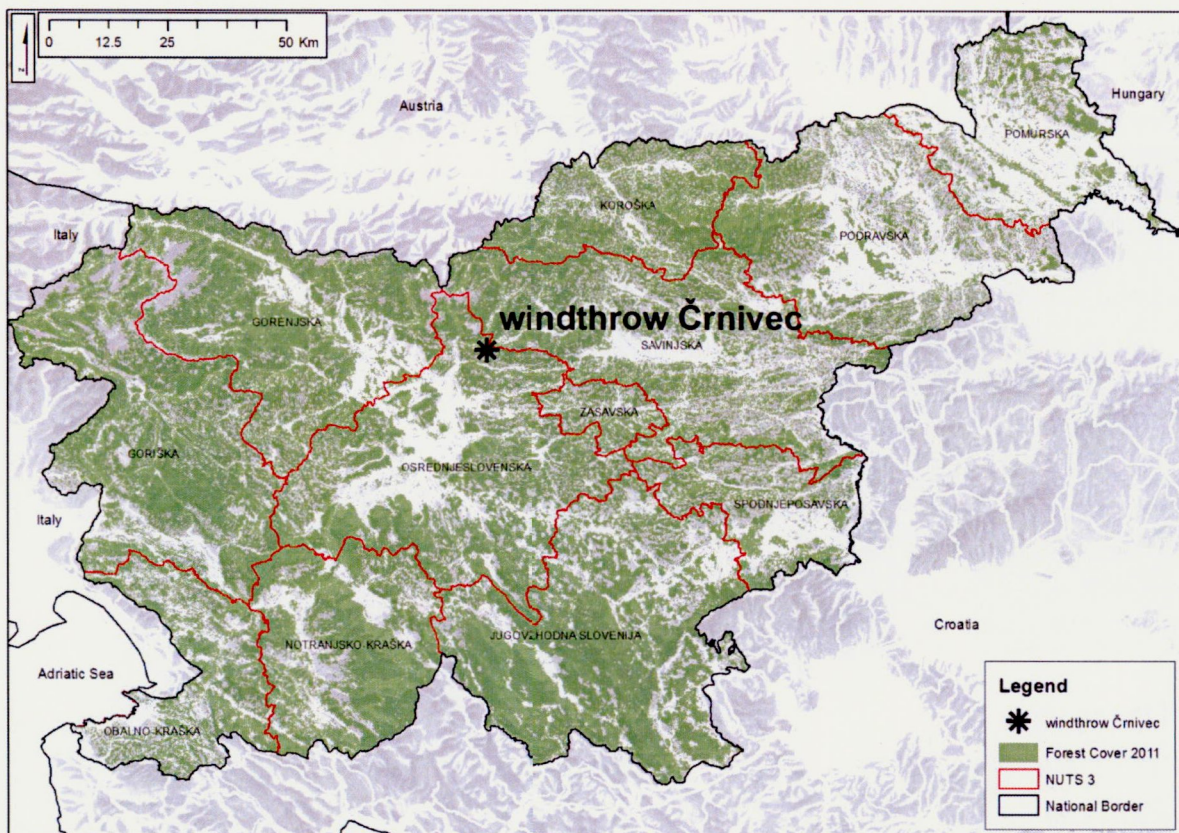


Date and name of the event

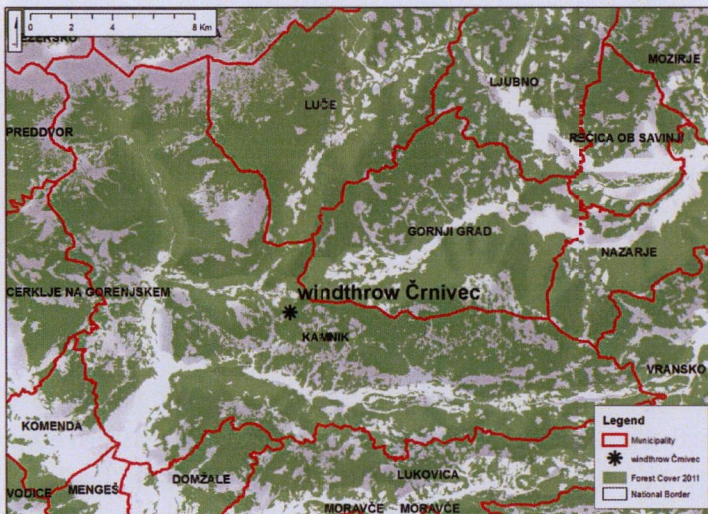
- Date of the event: July 13, 2008
- Extended events (yes/no): There was no extending events
- Agent (snow/wind, combined): Wind
- Link to a specific meteorological event: Strong turbulent wind after thunderstorm

Location of the event

Area of a large-scale windthrow in the area of Črnivec, in which forests, infrastructure, public and private buildings have been damaged, is located in the northern part of central Slovenia, on the south-eastern edge of Kamnik-Savinja Alps. The bedrock is mostly non carbonate, domain forest types are: Fagetum Submontanum, Hacquetio Fagetum, Blechno Fagetum and Bazzanio Abietetum, which by increasing altitude change into secondary spruce forests (Deschampsioflexuosae Piceetum) on beech sites (Luzulofagetum). The main tree species on all surfaces is spruce. The elevation of most damaged surfaces is between 600 and 1200 meters above sea level.



The event occurred in the forested area around Črnivec pass in municipalities Kamnik and Gornji Grad. Nearest towns are Kamnik and Gornji grad.



Ecology and economy of the event

Conditions of the affected area



Location of the event

WGS 84: E 14°42'08"; N 46°15'37,60"

Aspect: S, partially N

Height: 600 – 1200 m above sea level

Morphology: Varied terrain with steep slopes and narrow valleys.



- Forest types and pre-event management:

The windthrow affected older, even-aged, uniform spruce stands solely, whilst younger and more diverse stands hardly took any damage. Most of the trees were uprooted, especially in heavily damaged or destroyed forest stands, whereas broken trees were found mainly in moderately or less damaged parts of the forest. (Source: SFS, Central Unit Department for Forestry Technique, Slovenia).

Affected forest area is mostly private owned (9.062 ha, 98%). State-owned forests represent only 201 ha of forest (2%) on west side of Črnivec pass. Structure of private forest properties is rather fragmented and can be divided into two categories: small private forest estates of only few hectares versus larger forest owners (the largest forest estate of 128.81 ha is owned by the Catholic Church). (Source: SFS report)

Event description

- Causes and meteorological conditions

The catastrophic windstorm took place on the 13th July 2008 at around 2.00 pm and affected several parts of Slovenia. Turbulent wind that lasted between 10 and 15 minutes resulted in massive windthrow, which was concentrated on the slopes of both sides of the mountain pass Črnivec at the altitude from 600 to 1200 meters.

Impacts (see chart p. 5)

- Which of the functions of the wood/forest have been compromised?

Damaged forests belong to the category of multi-purpose forests mostly with ecological (protective, hydrological) and social (protection of cultural heritage) functions, at least at the 2nd degree of pronounciation.

- Which are the human consequences (casualties, etc.)?

There were no human casualties or injured due to the event.

- Is it possible to evaluate the economic losses?

Economic losses and amounts of damaged trees (timber) were assessed by Slovenia Forest Service in few days after the event. An aerial survey (aerial photos) of the whole area affected was conducted. The whole affected area was 9.263 ha and 328,000 m³ of damaged timber. Complete damage caused by windthrow Črnivec was assessed to 4.646.424 €. Large amount of available timber had negative effect on timber price. Extreme event will influence on forest estates also in the future – reduction of income (Source: SFS report).





| | Costs [€] | Co-financing by state [€] |
|---|------------------|---------------------------|
| Direct sanitation | 2.184.427 | 1.797.838 |
| Forest prevention | 63.929 | 63.929 |
| Forest health / forest protection | 297.727 | 245.741 |
| Rejuvenation measures and protection of seedlings | 1.099.690 | 439.876 |
| Rebuilding of skidding roads | 475.889 | 120.148 |
| Maintenance of forest roads | 524.762 | 245.096 |
| Total | 4.646.424 | 2.912.628 |

- Why the event is considered to be “extreme”?

The event is considered to be “extreme”, because of the size of the affected area, power of the wind and the amount of damaged timber. Post event management was a demanding task for Slovenian forestry – in management and technical point of view. Amounts of logged timber changed situation on wood market – result was a change of timber price. Bark beetle outbreak threat was an important factor after the extreme event.

Management

Pre-event

- Risk awareness

There is awareness of the fact that forests of Alpine region are exposed to periodic strong winds. Previous storms of that extent have not been recorded in the area.

Post-event adopted strategies

- Post-event (or planned) forest management (did the event affected the management policy? Or will it?)

First step in management of the affected area was to cut all the damaged trees and transport the timber from site for further processing, because of the danger of bark beetle outbreak. After that, measures for forest health protection, preservation of growth rate, improvements of biotic function were taken.

Main focuses in post event management have been set on proper techniques and timely logging, work safety, forest infrastructure and forest regeneration. Main ecological problems which arise during post event management were forest pest control (a great potential for bark beetle population growth) and soil erosion prevention.

- Economical management of the post-event situation

Damage evaluation, coordination of the owner activities and elaboration of management plans has been done by Slovenia Forest Service and financed by state budget. All the needed material (seedlings, protection...) was fully funded by the state budget. The costs of work (soil preparation, sowing, planting...) were co-financed (approximately 50 %). There were technical, environmental and economic limits to machine cutting. At the same time, nearly all forest owners in the area had been sufficiently equipped and



trained for forest work, what enabled them to carry out most of the activities in their forests by themselves and thus cut the costs considerably. Also neighborly solidarity was an important factor, which helped the owners to accomplish all the work in time. Because of these reasons, the combination of manual cutting and skidding by adapted tractors was prevailing.

- Secondary events occurred or monitored

In accordance to minimize bark beetle outbreak a very dense net of bark beetle slit trap has been planned.

Lesson Learnt

Črnivec windthrow is a successful example for joint approach to post event management on four main directions: ecological, technical, economic and social. Planning of treatment activities was selective on the basis of site conditions, estate size, forest owners knowledge and technical equipment.

After the logging artificial reforestation was done on most affected surfaces. As the spruce has proved as less suitable species for this kind of climatic and site conditions, the SFS supported planting of mostly deciduous trees. Finally, a question arose how to design forest regeneration in the way not to create future even-aged uniform stands on large scale, which had proven to be very poorly resistant against natural disasters.

The key factors of successful windthrow management in the case of Črnivec windthrow are personal approach to each forest owner concerned, careful consideration of forest owners individual situation, intensive appeal on the general public and political authorities, making compromises to some degree in order to keep professional competence and public sympathy and at last but not least: work safety must be given the highest priority.





Acknowledgement

The report is also part of the CRP project V4-1069 (Improving efficiency of sanitary actions following major forest damages in Slovenian forests) which was financed by the Ministry of agriculture and the environment (MKO) and the Slovenian Research Agency (ARRS).

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Second level analysis on extreme windthrows, snow damages and abiotic occurrences

SLOVENIA - windthrow Jelovica

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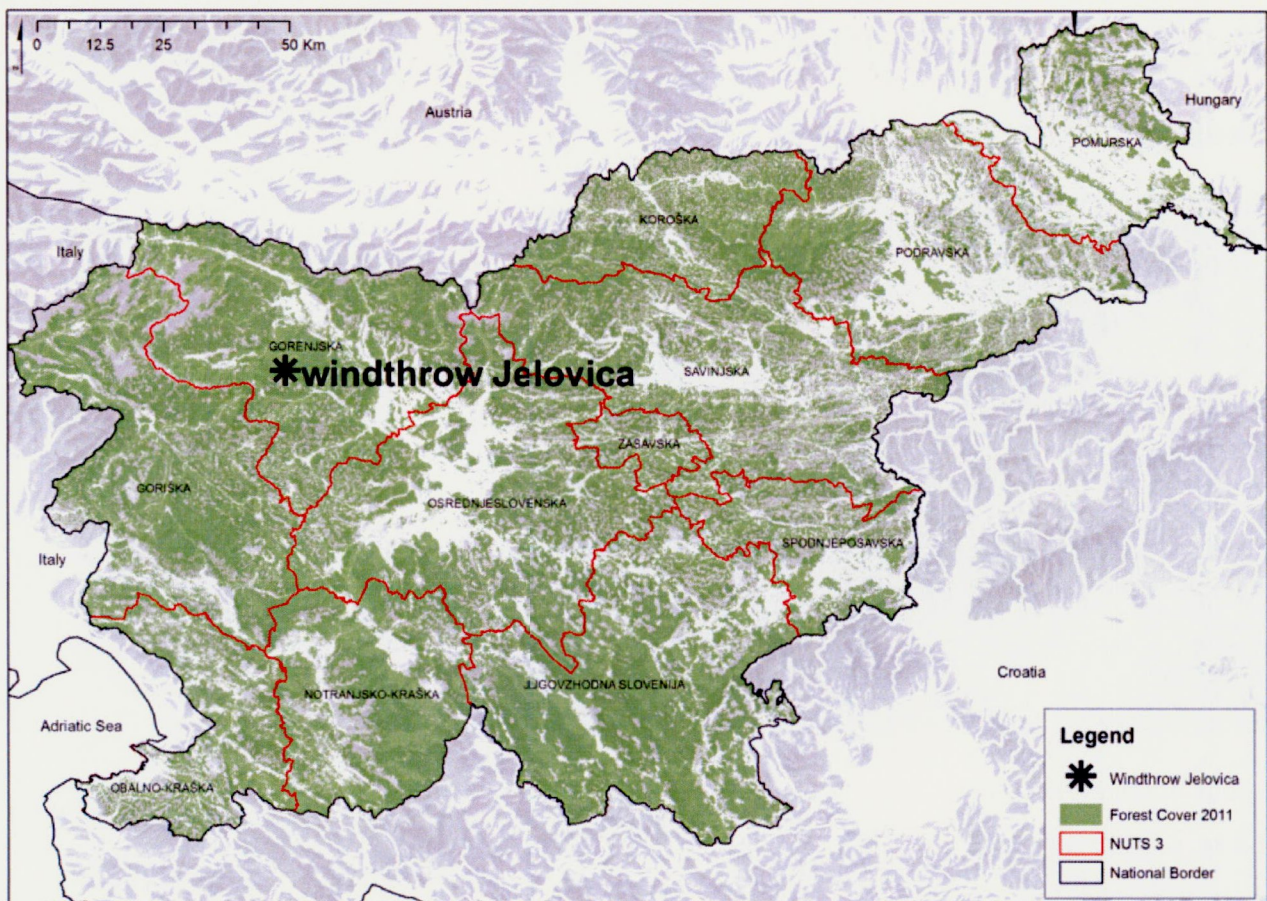


Date and name of the event

- Date of the event: June 29, 2006
- Extended events (yes/no): There was no extending events
- Agent (snow/wind, combined): Wind
- Link to a specific meteorological event: Strong wind after thunderstorm

Location of the event

Plateau Jelovica, where the wind through occurred, belongs to the Bled forest management unit, which lies in the north-eastern part of Slovenia more precisely between the Southern part of Julian Alps and Western part of Karavanke. General characteristics of this area are: high Karst, heavy rainfall and rapid weather changes. Dominant forest type is Illyrian mountainous beech forest (*Homogynosylvestris-Fagetum*), but the main tree species are not beech and fir, but spruce. The bedrock is mostly limestone. The elevation is between 1000 and 1400 meter above sea level.



The event occurred on the border between municipalities' Železniki and Bohinj. Major towns that are around are: Bohinjska Bistrica, Železniki, Radovljica, Bled, Lesce, ...



Ecology and economy of the event

Conditions of the affected area



Location of the event

WGS 84: E 14°5'1,19"; N 46°15'41,37"

Aspect: N, partially E

Height: 1000 – 1400 m above sea level

Morphology: Limestone plateau



- Forest types and pre-event management:

Affected forests were mostly older spruce forests (monoculture, high forest stands). In those parts of Slovenia management of the forests is quite intensive. At the time of the event average growing stock in the affected forest was 530 m³/ha. Affected area is mostly public property (105 ha, 66 %) and private property (55 ha, 34 %). Private forest is divided between 5 owners. Small number of owners and consequently larger properties are the main reason for intensive management in these forests, even in harsh environment (high altitude, shorter vegetation period...). (Source: SFS report)

Event description

- Causes and meteorological conditions

Windthrow Jelovica has occurred on 29 of the July 2006 in the afternoon (around 4.30 pm). In the afternoon of the same day, after a month of sunny and very warm weather, all across the country storms developed.

The eyewitnesses (two shepherds at Ribčeva planina, pasture nearby) have told that at that day the atmosphere was really calm. Suddenly the fog appeared and in a few minutes a very loud thunder approached. The duration of the thunder was only approximately 10 minutes. The wind blew in direction from SE to NW.

Impacts (see chart p. 5)

- Which of the functions of the wood/forest have been compromised?

At the Jelovica plateau the main function of the forest is wood production, so this was the main function that was compromised because of the windthrow. As secondary damage also the protective function was compromised, because of erosion on quite a few parts of the area.

- Which are the human consequences (casualties, etc.)?

There were no human casualties or injured due to the event.

- Is it possible to evaluate the economic losses?

Economic losses and amounts of damaged trees (timber) were assessed by Slovenia Forest Service in few days after the event. An aerial survey (aerial photos) of the whole area affected was conducted. The whole affected area was 160 ha and 85,000 bto m³ of damaged timber. Complete damage caused by windthrow Jelovica was assessed to 1,271,076 €. (Source: SFS report)





| | Costs [€] | Co-financing by state [€] |
|---|------------------|---------------------------|
| Direct costs of organization of work | 15,440 | |
| Estimate of reduced profit because of early felling | 548,225 | 90,450 |
| Loss because of unrealised increment | 191,955 | |
| Direct sanitation | 69,104 | 16,275 |
| Forest health / forest protection | 42,076 | 24,326 |
| Revegetation and protection of seedlings | 171,968 | 101,389 |
| Rebuilding of skid roads | 77,908 | |
| sanitation of roads | 154,400 | |
| Total | 1,271,076 | 232,440 |

- Why the event is considered to be “extreme”?

The event is considered to be “extreme”, because of the size of the affected area and the amount of damaged timber. Also the regeneration of the forest was a demanding task for Slovenian forestry – in management and technical point of view. Also it was very important to efficiently cut down damaged trees and transport the timber from site as soon as possible because of threatening of bark beetle outbreak.

Management

Pre-event

- Risk awareness

There is awareness of the fact that forests on Jelovica plateau are exposed to periodic strong winds.

Post-event adopted strategies

- Post-event (or planned) forest management (did the event affected the management policy? Or will it?)

First step in management of the affected area was to cut all the damaged trees and transport the timber from site for further processing, because of the danger of bark beetle outbreak. After that, measures for forest health protection, preservation of growth rate, improvements of biotic function were taken.

- Economical management of the post-event situation

It was not possible to find any information on the economic management of the post-event situation. Most of the logging was done by special logging machines.





- Secondary events occurred or monitored

In accordance to minimize bark beetle outbreak a very dense net of bark beetle slit trap was planned. Nevertheless, on destabilized edges of the area, in next few years the number of trees affected by bark beetles increased.

Lesson Learnt

After the logging artificial reforestation was done and the question appeared how to provide enough spruce seedlings from the right provenience.

After the event the expert team for crises management was established: the owner, the contractor and personnel from Slovenia Forest Service. Very important was the continuous communication and cooperation between those services.

All the forest roads in the area were closed with gates and equipped with warnings and information tables. Only Slovenia Forest Service personnel and the contractors were allowed to enter the area, due to the high danger of working machines. Other visitors were not allowed to enter the area.

Quite a few articles in media about successful sanitary actions of the area were published. It also contributed to better recognition of forestry and Slovenia Forest Service.

The assessment of affected area and volume of damaged timber was quick, effective and objective with the use of modern technology. The Ministry of Agriculture, Forestry and Food of Republic of Slovenia financed aerial survey and orthophoto images of the affected area. The borders of destroyed forest stands were the same as the forest stand borders in Slovenia Forest Service inventory. The data from survey on permanent sampling grid in management unit (in 2002) were used to calculate volume of damaged timber (by species and diameter classes; (damaged timber growing stock = growing stock in 2002 – felling in period 2003-2005 + increment in period 2003-2005)).

During the sanitary actions of damaged area a lot of machinery (harvesters, forwarders...) from Slovenia and neighboring countries (especially Austria) were involved and in some way this was also great opportunity for the operators of the machinery to learn from each other and to exchange their good practices.

The windthrow affected mainly average steep slopes. Nevertheless, we were surprised by the amount of area affected by erosion in first year after sanitation. The erosion was a consequence of the high amount of rainfall and very shallow soils on limestone.





Acknowledgement

The report is also part of the CRP project V4-1069 (Improving efficiency of sanitary actions following major forest damages in Slovenian forests) which was financed by the Ministry of agriculture and the environment (MKO) and the Slovenian Research Agency (ARRS).

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Second level analysis on extreme abiotic occurrences

SLOVENIA (Karst area) - fire Šumka

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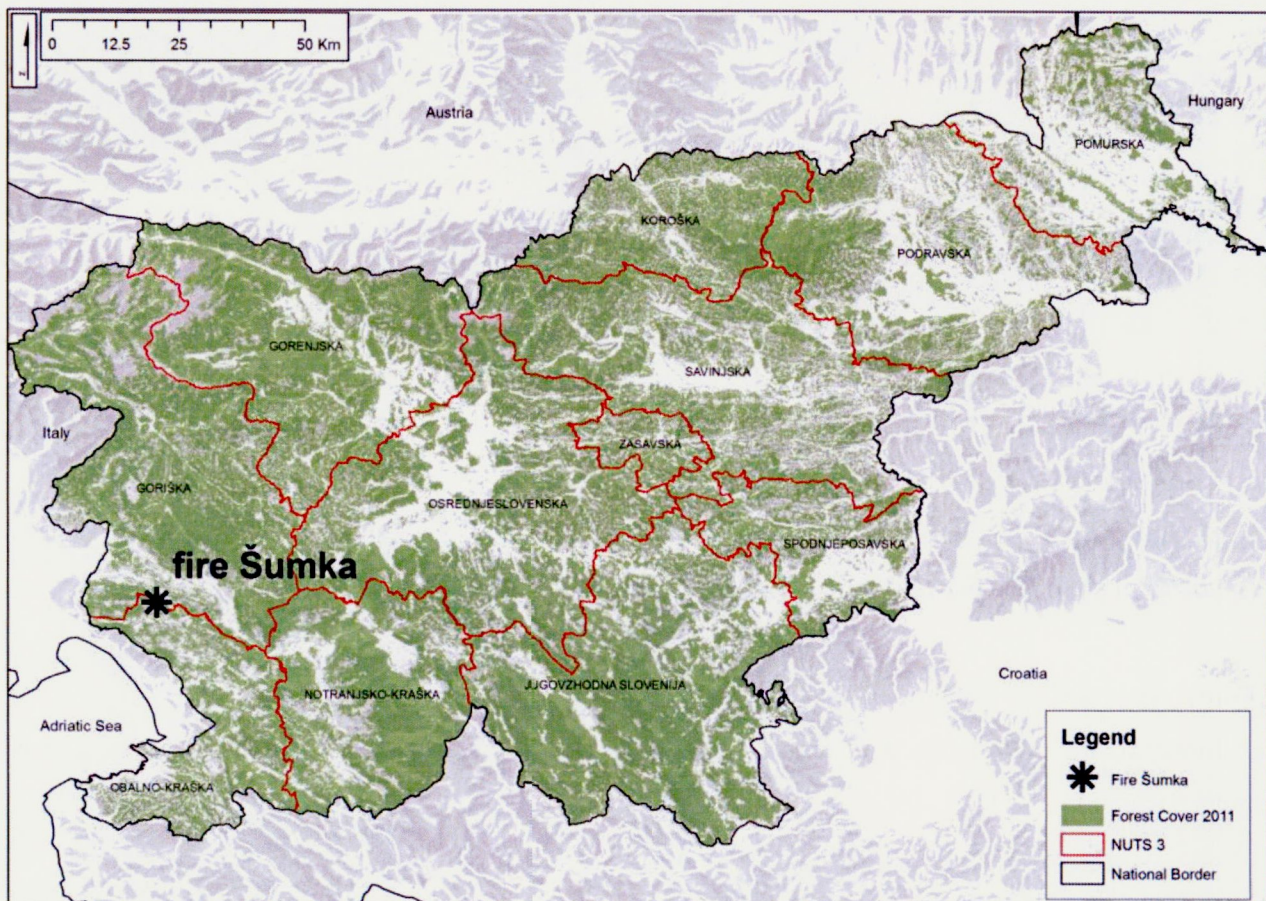


Date and name of the event

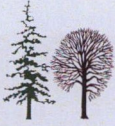
- Date of ignition: 21. July 2006 (at 17:05)
- Date of extinction: 26. July 2006
- Name: Fire Šumka at Karst

Location of the event

Area is located in west part of Slovenia, in the Karst region. This area was in 19th century almost completely bare land, because of long use of wood (heating, construction) and pasture. Only Austrian pine (*Pinus nigra* Arn.) was successful enough in reforestation of this harsh environment. On the presented area are mostly high stands of Austrian pine (*Pinus nigra* Arn.) and coppice of broadleaves (*Ostrya carpinifolia* Scop., *Quercus sp.*). (Source: SFS report)



City's or towns that are nearby are Sežana, Nova Gorica, Branik, Škrbina, Trstelj, Komen



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Ecology and economy of the event

Conditions of the ignition point



Location of the ignition point

WGS 84:E: 13° 46' 29,39"; N: 45° 50' 39,01"

Aspect: southeast, SE (150°- 160 °)

Height: ~ 300 m

Morphology: base of the hill Veliki hrib, slope of the hill

- Forest types and pre-event management:

High forest stands of Austrian pine (*Pinus nigra* Arn.) with oak (*Quercus* sp.) and broadleaves (*Ostrya carpinifolia* Scop.).



Conditions of the affected area

- Site characteristics (if different from ignition point conditions):

Site characteristics are quite the same in whole affected area. The forests covering the area are surprisingly in good quality for this harsh environment and poor conditions (shallow ground).

- Forest types and pre-event management (if different from ignition point conditions):

High forest stands of Austrian pine (*Pinus nigra* Arn.) with oak (*Quercus* sp.) and broadleaves (*Ostrya carpinifolia* Scop.). The whole burned area was 950 ha, of which 707 ha of forests. 82 % of forests are in private property, the rest (18%) is public property (country or municipalities). (Source: SFS report)

Event description

- Causes

The cause of ignition is unknown. The ignition point was at the road Komen-Branik, so it can be assumed that the ignition was a consequence of human activity.

- Consideration about meteorological conditions (values of Risk Indexes, if available)

At the time of ignition (July 21, 2006), the meteorological conditions were almost ideal for fire. More than 40 days was from last (worth mentioning) rain. In last two months fell only 9 - 29 litre of rain (6-12 % of average rainfall in that time of year).

Meteorological data for nearest weather station (July 20, 2006, 12:00) was:

- temperature: 35.7 °C
- atmospheric pressure: 1006.3 mb
- wind (speed, direction): 1.3 km/h (0.4 m/s), S
- relative humidity: 19 %
- insolation: 805.8 W/m²

From 20th of July 2006 'very high risk of fire in natural environment' was declared.

- Type of fire

Ground fire affected 40 % of the area (cca. 283 ha) and crown fire affected 60 % of the area (cca. 424 ha). (data by SFS)





- Event timing and spatial evolution?

Friday, July 21, 2006: Fire started around 5 pm near road Komen – Miren. Fire fighters from professional fire unit Nova Gorica and voluntary fire fighters from 9 local units were sent to the fire site. At the same time, a few other fires in vicinity (~ 20 km) were in progress. Some of the fire fighters, who were already at the scene (fire Šumka), respond to their local fire sites. On the left edge of fire Šumka was not enough man power and with wind (SW), fire spread to W, SW and up the hill Šumka.

Saturday, July 22, 2006: During the day more than 200 firefighters on ground and with help of helicopters fought the fire Šumka. In the evening some units from central part of Slovenia came to help. Helicopters of Ministry of defense, Slovenian armed forces (bell, cougar), planes (canadair) and helicopters (sikorsky) from Italy were at scene. Unfortunately, at use of 'counter fire', the fire got out of control (lack of firefighters and not enough water) and fire spread even more. By the evening 420 ha were affected.

Sunday, July 23, 2006: Fire suppression continued during the night and in the morning with new teams. More than 400 firefighters were at site. In the afternoon, very fast spread of the fire to the north happened up the hill Lipnik (north of village Škrbina) and in the evening (around 10pm) the fire spread also to hills nearby, because of the wind, which was constantly changing direction. The fire was getting closer to the villages (Škrbina, Šibelji), so the firefighting units were sent to preventively wet surrounding area of the road and buildings. At the end of the day, 890 ha were affected.

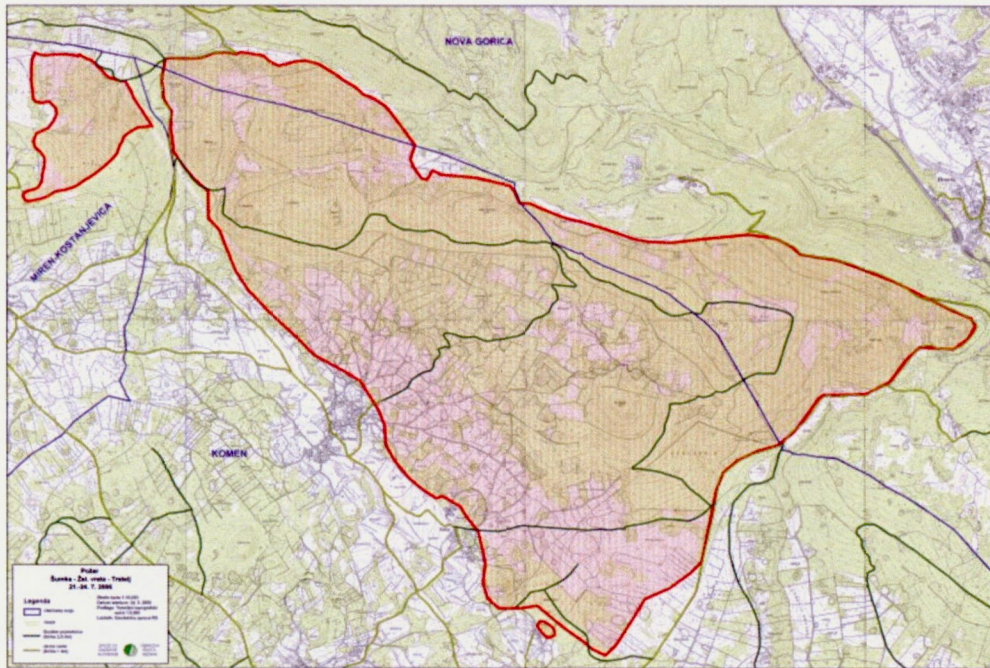
Monday, July 24, 2006: Because of strong wind, fire "jumped" and vegetation on the hill Trstelj started to burn. The "fire jump" was more than 300 m long across the road Lipa – Dornberk. In the evening, the fire was under control.

Tuesday, July 25, 2006: A survey from air was done; some spots of ignition at the edges of burnt site were seen and extinguished.

Wednesday, July 26, 2006: The burnt areas were observed. It also started to rain in the afternoon. It was officially announced that the fire was extinguished in the afternoon. Some units stayed to control the burn site.

Thursday, July 27, 2006: The burnt site was still observed. The intervention was finished in the afternoon.





http://www.pgdkomen.si/dokumenti/Katastrofalen_pozar_SUNKA_2006.pdf (by Slovenia Forest Service)

Impacts

- Which of the functions of the wood/forest have been compromised?

With the fire, the functions of forest were compromised – productive and habitat functions. Immediate consequences on affected areas were seen at soil erosion prevention and hydrological function. The whole burnt area is very important for providing water for the Karst region.

- Which are the human consequences (casualties, etc.)?

In the fire Šumka were no human casualties. Evacuation from nearby villages was not needed. Also no buildings were damaged in the fire. More than 2000 firefighters were at fire site, 20 of them got minor injuries, mostly minor burns of extremities. Two firefighters were in car accident and got minor injuries.

- Is it possible to evaluate the economic losses?

First assessment of economic losses was approximate 885.000 €. (Source: SFS report)

- Why the event is considered to be “extreme”?

The event ‘fire Šumka’ is considered extreme, because it was the second largest forest fire in Slovenia (whole burned area – 950 ha, forests – 707 ha) in period 1995 - 2010. The largest fire was in 2003 near





village Sela na Krasu (approximately 15 km west), where burned area was 1.048 ha (748 ha of forests). (Source: SFS report)

Management

Pre-event

- Operative prevention protocols

The Notification centre of the Republic of Slovenia and the 13 regional notification centres operate 24 hours a day. The system works under the regulation of Ministry of defence, Administration for civil protection and disaster relief. The key tasks of the regional centres are the response to 112 emergency calls and the provision of dispatch services for all rescue services. Firefighting units (professional and voluntary) are organised and quite well equipped. Roads and other preventive objects are maintained.

- Risk awareness

July 20, 2006 the highest level of fire risk level (level 5, on a scale from 1 to 5) was declared.

Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (ACPDR-<http://www.sos112.si/eng/>) is the organisation responsible for declaring the level of fire risk, according to measurements, calculations and suggestions of meteorological service (Slovenian Environment Agency) and other organizations (also Slovenia Forest Service). In correlation with the fire risk level, several restrictions are declared – i.e. prohibition of use of fire in natural environment, trains have to reduce their speed and municipalities are obliged to supervise the endangered forest areas.

Event ongoing

- Fire fighting strategy and efforts

The strategy with facing the fires in natural environment is to detect a fire as soon as possible and to extinguish the fire, while it is manageable with small team of firefighters. The system of reporting and alarming is established through local people. Especially in Karst region, where the most of Slovenian fire occur, the settlements and inhabitants are much dispersed and this is the main reason why the fires are quite fast noticed and reported to the Notification centre of Republic of Slovenia (phone number: 112). The second condition for successful intervention is good network of transport routes (public roads, forest roads and special intervention routes in forests). The Slovenia Forest Service is in charge of maintenance of





special intervention roads in forests. The next condition is a wide network of firefighting units (professional and voluntary), which is well equipped, trained and it is able to respond immediately.

More about fire fighting strategy and efforts is written at Event timing and spatial evolution of the fire Šumka.

Post-event adopted strategies

- Post-event forest management

The post-event management of burnt site was mainly focused on reforestation of the areas, burnt by crown fire. The activities planned were: sowing on less qualitative growing sites (235 ha) and planting with acorns on better growing sites (24 ha). On the other areas was planned to continue with management as before and some earlier cutting in older stands. The event did not influence the post-event management policy in general. After a large fire in 1994 (Renče), national policy of post-event management after fire (co-financing the sanitation from national budget...) was established. However, there is a lot to be done in assessing the activities and the results of post-event management in previous fires in Slovenia, with some deepening studies which would give some practical guidelines. The main objective in post-event management is primarily to restore the ecosystem, to establish its previous functions as soon as possible. The economic benefits were not calculated, the public interest is to restore the soil erosion prevention, hydrological function, etc. However, the event did have the effect on improvement of firefighting policy and management. (Source: SFS report)

- Economical management of the post-event situation

All the measurements, coordination of the owners and managements plans were done by Slovenia forest service and financially covered by national budget. All the needed material (seedlings, protection...) was fully funded by budget. The costs of work (soil preparation, sowing, planting...) were co-financed (approximately 50 %). At the end of post-event management, including the income of timber, costs of reforestation and subsidies from the state, the owners had profit of 6 € per m³.





Lesson Learnt

The most important issue to improve was noticed in coordinating the activities. The event has shown that it is necessary to improve the system of monitoring the development of the fire, locating the resources (firefighting units, equipment, machinery etc.) – to support quick and effective decisions in headquarters.

In this fire situation we could stress the importance of well-defined protocol for decision making. The ignition point of fire Šumka was located in area at the border of two regions (different dispatch units). Calls came from both regions and it took some time to coordinate all the units and the incoming information.

Some logistical issues were noticed due to different use of fire hose coupling (different in use by Slovenian and Italian firefighters).

During the intervention also air units (helicopters, planes) participated. Some improvements could be done in coordinating the aerial and terrestrial units in extinguishing fire in the same area.

The vast majority of fires in natural environment in Slovenia are in Karst region (west, southwest of country), due to warm and dry climate. In other parts of Slovenia, forest fires are very rare and the burn area is usually smaller. At the intervention Šumka, many voluntary firefighters from other parts of country came to help. During the intervention it was noticed that, even with great amount of enthusiasm, the units from other parts of country were not enough equipped and skilled for this type of fire. There is a need of more specialised training of voluntary firefighters in fighting fires in natural environment.

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