

# Understanding, Predicting and Managing a Windthrow



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The aim of our research was to present the major windthrow that occurred on the 13th of July, 2008 and damaged mountain pass Črnivec. Specifically, we examined the damaged forest areas with the use of remote sensing data, effects of planned and preventive reforestation as well as the reconstruction of buildings and roads, especially considering long-term approach of integrating resources and knowledge in the prevention.



## Problem overview

- Lack of research in this field.
- Researching the **windthrow that happened in our surroundings** and focusing on the effect that had it on the environment as well as on the people who live in the area.
- Researching the influence that the preventive construction and foresting have on the windthrow hazard areas.



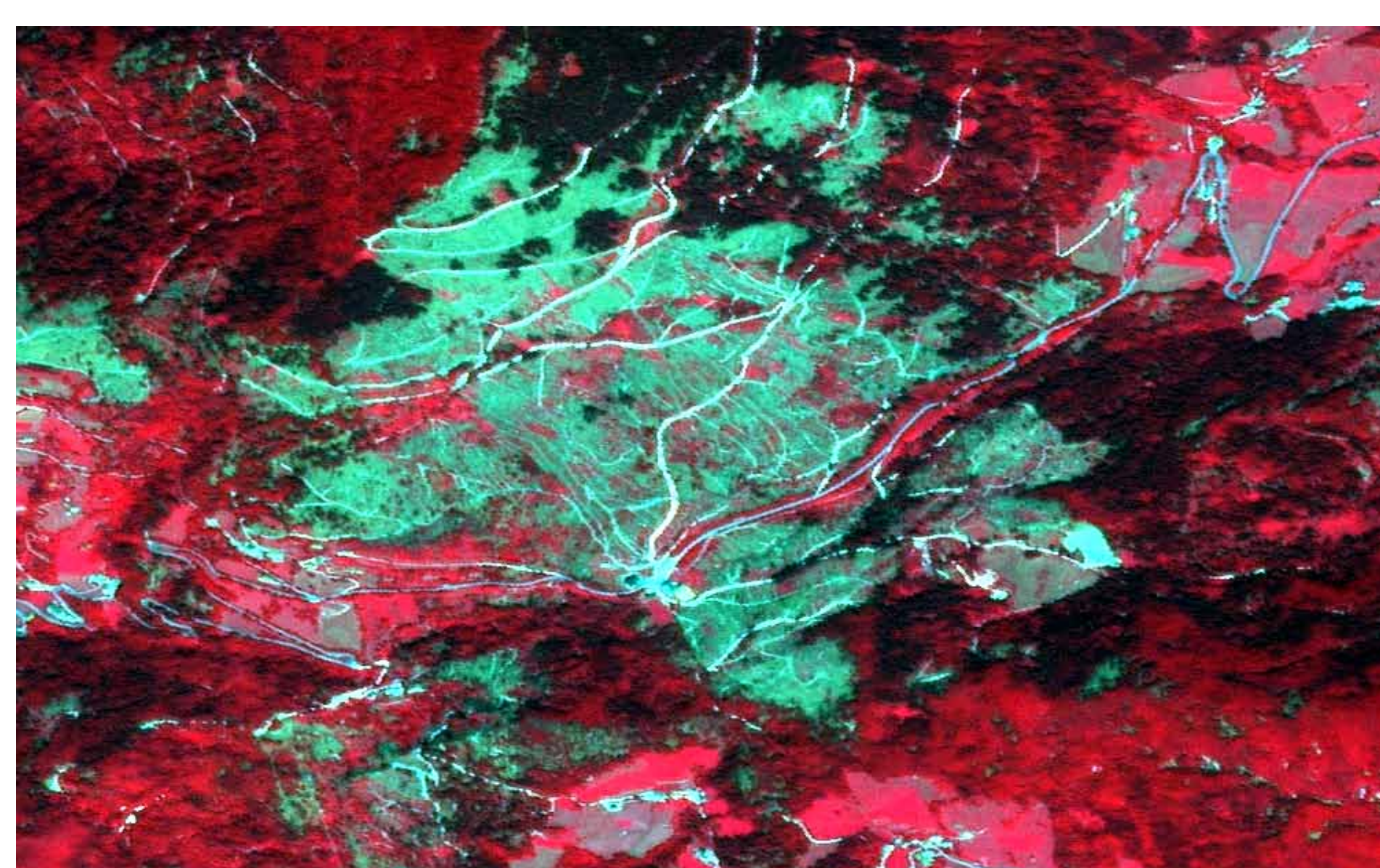
Ruins of damaged houses in Gozd.



The storm left behind huge areas of fallen trees.

## Data

- Digital orthophoto imagery for 2006 (RGB and NIR), 2011 (RGB only).
- SPOT 5 satellite imagery for 2007 and 2009.
- Digital terrain model with 5 m spatial resolution.
- Radar imagery and weather reports from Slovenian Environment Agency.
- Additional damage and reforestation process data from Slovenian Forest Service.

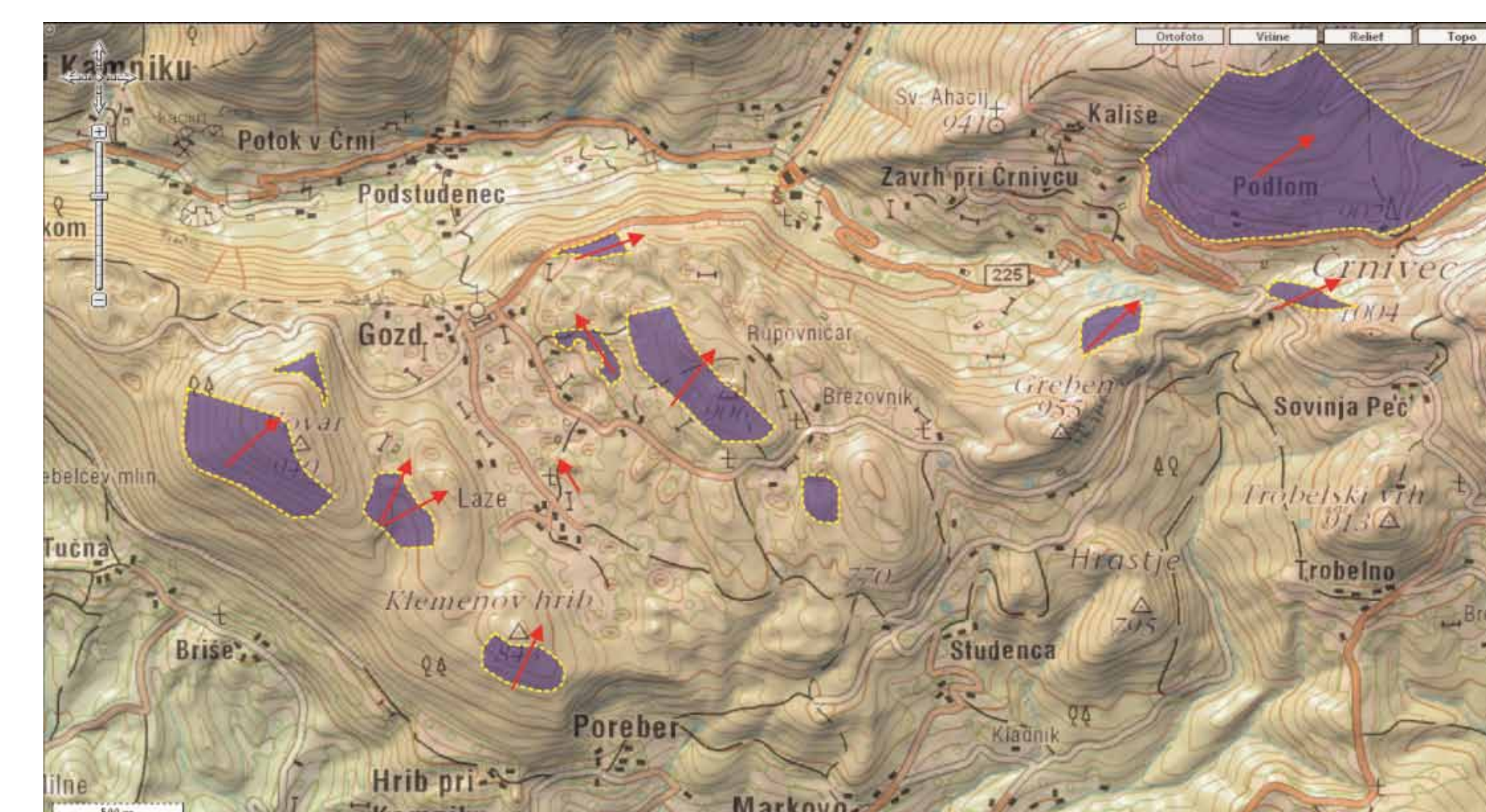


SPOT 5 false color satellite image of the Črnivec area one year after the windthrow shows areas where the forest once was but is demolished now (green colour).



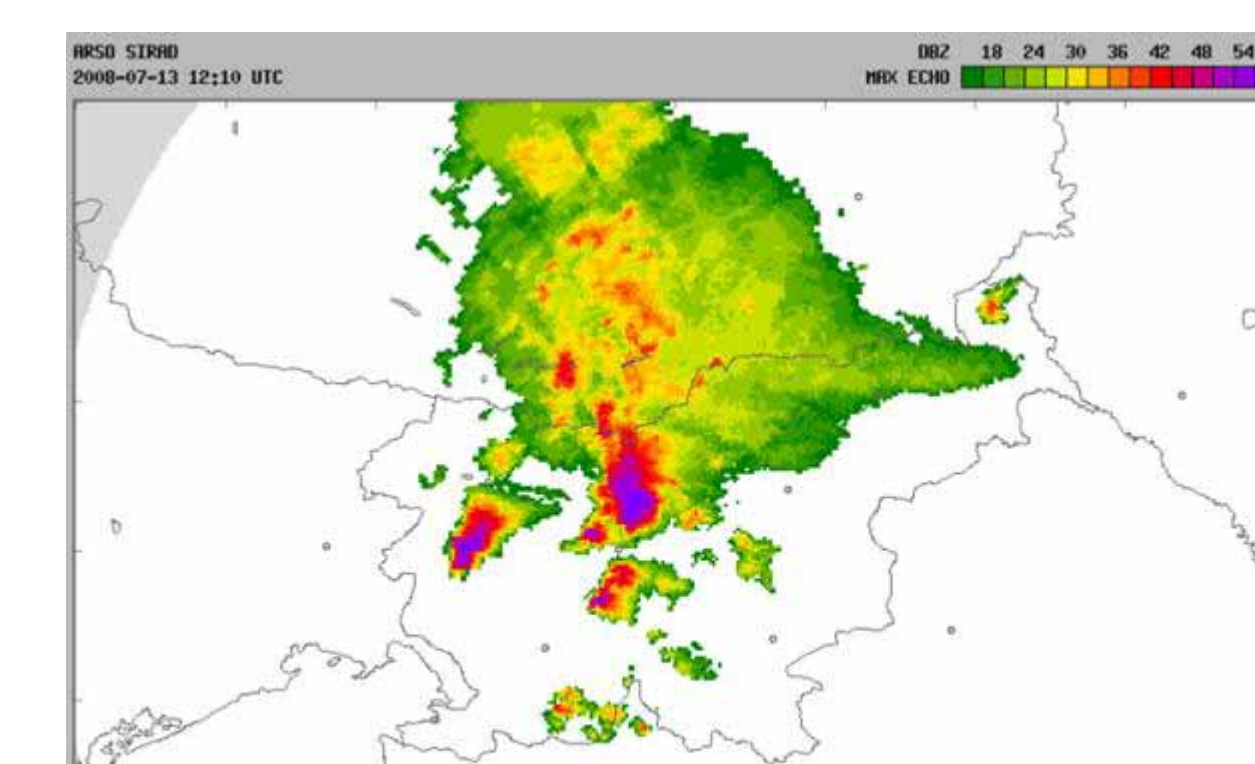
RGB digital orthophoto from 2006 (left) and RGB orthophoto from 2011 (right) of the Gozd area. Most of the demolished forest was **coniferous**, which can also be seen on NIR imagery in dark red color.

- Geological chart composition interpretation proved our conclusion that the damage was greater in limestone areas than in silicate ones.



The direction of the blowing wind in the area of Gozd and Črnivec at the time of the storm. Mostly it blew in the SW-NE direction but in some places it changed its course and blew perpendicularly in that direction and razed buildings and forest with even greater force. Credits: Marko Premelč.

- The damage was greatest on steep slopes and underneath the mountain tops.
- 140 ha of the forests were completely destroyed in the storm.



The happenings around 2 p.m., when the storm emerged over the Kamnik area. The colours from red to purple mark the large torrential particles (large drops and hail).

## Methods

- Interviewing the local people.
- Visual interpretation of archive satellite and orthophoto imagery and photographs from the field.
- Study of incline, terrain and ground composition.

## Conclusions

From disasters like that we can learn a lot about managing the consequences of windthrows, so the effects are less severe in the future. The buildings in the village of Gozd were not preventively reconstructed, so the damage could be bad or even worse if windthrow occurs again. The solution could be in adjusting the buildings to suit the weather conditions and informing the local people about the various possible measures. Engaging in forestry is also of great importance because forests have great influence on our environment.