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FACTORS THAT TRIGGERED WINDTHROWS WITHIN THE UPPER BASIN OF THE LUNCAVAT RIVER BETWEEN 2nd AND 4th OF JUNE 2009

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Abstract: This paper – a case study – is aimed to analyze the ensemble of factors connected to the 2-4 June 2009 windthrows and wind brakes in the upper basin of the Luncavat River forests. It was the configuration of baric systems crossing Romania which enabled abundant rainfalls on June 3rd, weakening the resistance of tree roots, while strong winds blowing V, NV-SE across the Northern Oltenia highlands on June 4th and directed along the Luncavat River valley brought about endemic windthrows and wind brakes North of Vaideeni. This phenomenon affected a 7.5 ha area and 215 m^3 of wood, mainly beech but especially spruce and fir.

Key words: catastrophic winds, Romani Forestry, Northern Oltenia, meteorological factors, geographical features, characteristics of the woods

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INTRODUCTION

On 2-4 June 2009, windthrows and wind brakes affected an area of 7.5 ha (215 m^3 of wood) in the upper basin of the Luncavăţ River, an Southwest exposure North of Vaideeni.

Windthrows are the most important risk factor in mountain areas, with negative effects on economy and ecology as well (Popa, 2002).

Foresters classify windthrows into two large groups within forest ecosystems, based on wind's action: *catastrophic* and *endemic*.

Catastrophic winds generate massive damages and are connected to certain extreme meteorological conditions of a special character (very high speed winds); they affect large areas (hundreds of hectares) and hundreds of thousands of m^3 of wood. This kind of windthrows is rarer, once in 10-15 years, and impacts most species of undergrowth, regardless of their strength. Across Romania, the volume of destroyed wood can reach at least 100,000 m^3 on such an event. In 1995, 7-8 million m^3 of undergrowth in Harghita and Covasna Counties were damaged.

Endemic windthrows occur yearly in the undergrowth vegetation; they are caused by medium-speed winds and bring about the most severe damages. Covering large areas, such windthrows are related to local and meteorological factors as well as to undergrowth conditions (biometric and quality parameters, structure etc.). This category includes scattered or small-group (5-10 trees) windthrows as well as massive ones that affect certain undergrowth populations within relatively small geographic areas. In the upper basin of the Luncavăţ River there were recorded endemic windthrows.

Localization

The 2-4 June 2009 event affected mainly the North of Vaideeni undergrowth, on the left bank of the Luncavăț River, within Romani Forestry. This tributary of the Olt River is oriented north-south in its upper basin and crosses areas 600 m in altitude along the valleys and 900 m altitude on the versants. It is worth noticing that trees were broken down up to the streamline, mostly in crook areas (figure 1).

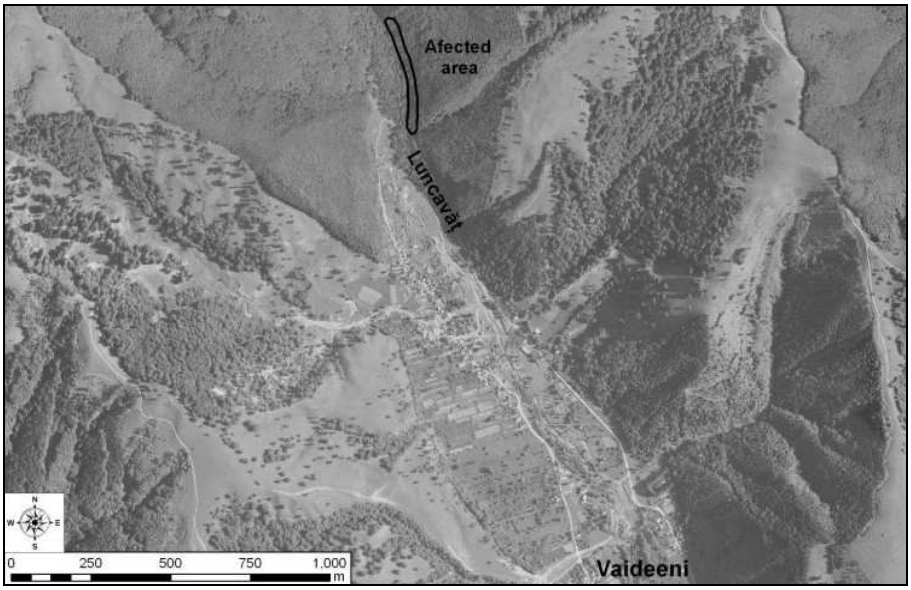

Figure 1. Location of the 2-4 June 2009 windthrows

Genetic factors favoring windthrows

Windthrows are generally caused by a composite ensemble of factors such as: meteorological factors (strong winds, snow storms, abundant rainfalls, white frost deposits, glazed frost, and frozen snow), geographical features (orientation of mountain ranges, altitude, versant exposure to general atmospheric circulation, slopes etc.), characteristics of the affected woods (position in relation to wind direction, tree species, age, thickness etc. as well as the type of soil where affected trees are rooted in).

Configurations of baric systems over certain areas and cyclonic formations in particular are the cause of strong wind gusts in a number of synoptic situations. Wind speed amplifications are due to baric configurations as well as to the orientation and fragmentation of relief forms. These concur to channeling the winds and changing their direction as well as to generating a number of damaging effects related to high speeds. In *large valleys*, currents are generally directed along the valley (downwards or upwards, depending on how the valley is oriented in relation to the main currents), while in *small*, lateral *valleys* winds cannot be directed and follow their main course, causing windthrows of a lower intensity and only in the vicinity of crests; a greater number of windthrows occur *on the hill tops of exposed valleys*.

SYNOPTIC CONDITIONS

On 2-4 June 2009, Romania's geographic area was under the influence of a low pressure field generated by a low-pressure couloir between a Mediterranean cyclone on trans-Balkan trajectory and an Icelandic mobile cyclone that migrated to the Baltic Region (figures 2 and 3). On the other hand, the vertical structures, being slightly west of the ground low-pressure center, increased the virulence of this mobile cyclone.

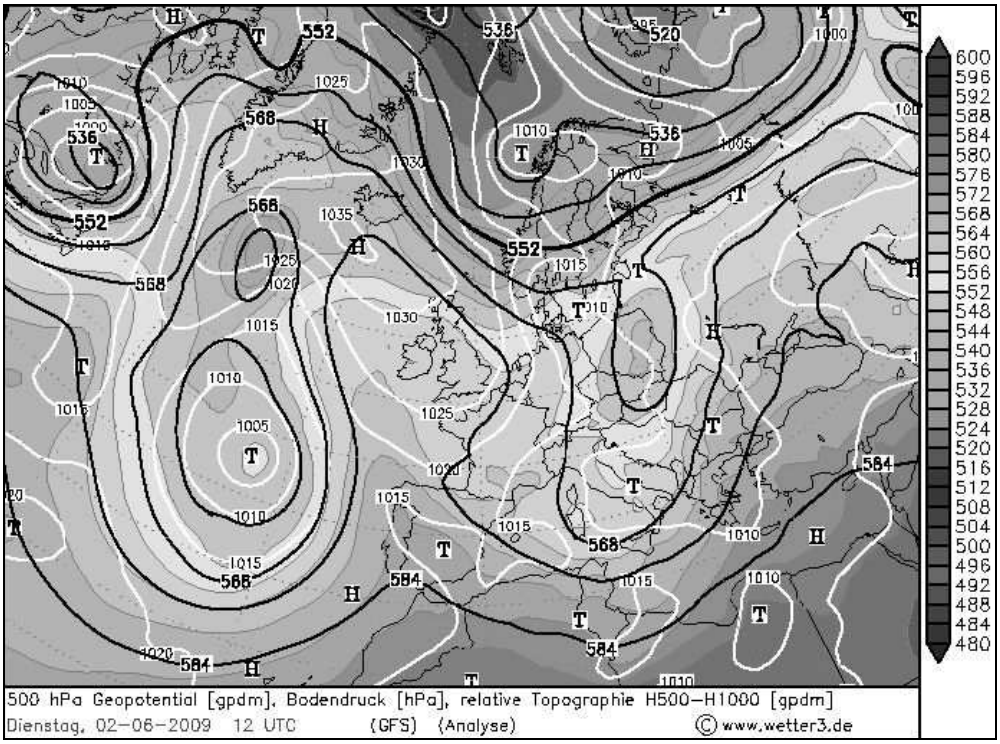

Figure 2. Synoptic conditions on 02 06 2009, 12 UTC

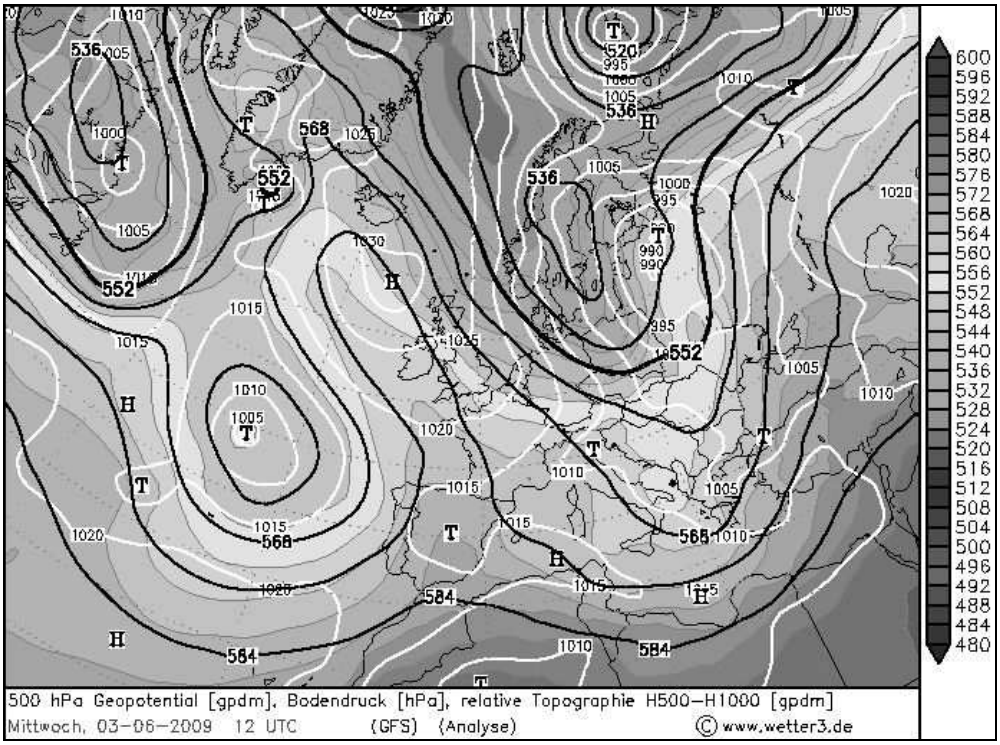

Figure 3. Synoptic conditions on 03 06 2009, 12 UTC

It is well known that the Mediterranean cyclone – Icelandic low tandem generates significant precipitation amounts in every region of Romania and mostly in the west and south-west. We can mention amounts higher than 90 mm fallen in less than 24 hours in Northern Oltenia and also amounts topping by far the multi-annual means for June (figure 4). On the other hand, such events took the form of downpour and torrential rain, which are related to very unstable weather conditions – a characteristic of the season wherein they occurred. There were also recorded significant wind gusts during the interval. Although there were not registered marked pressure gradients on ground level, given the Cumulonimbus formations with great vertical development – generally related to torrential rain – that were seen in the analyzed case, there were recorded high speed winds mainly in the higher areas from Northern Oltenia.

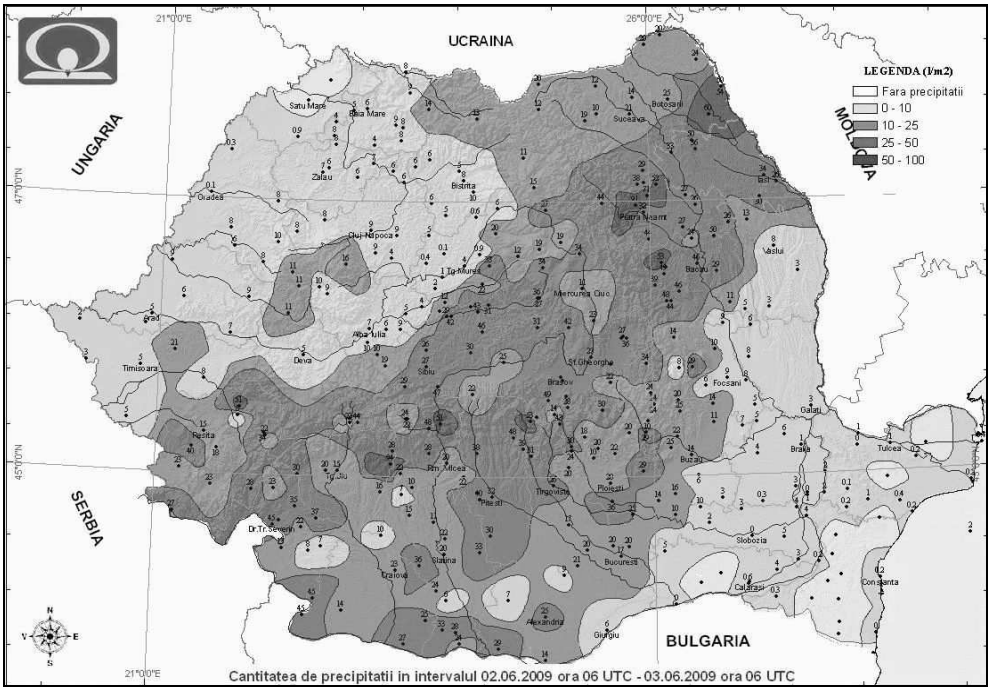

Figure 4. Precipitation amounts on 02/03 June 2009

INTENSITY AND DURATION

Abundant and torrential rainfalls in the night of June 3rd (Table 1) resulted in streams that, on crossing the area, diminished the resistance of undergrowth roots. More intense wind gusts from V, NV to SE were recorded mostly in the higher lands of Oltenia.

Table 1. Precipitation on 3rd of June h 06 UTC

Weather station	l/m^2
Padeş - Apa Neagră	29.8
Târgu Jiu	15.4
Polovragi	28.0
Târgu Logreşti	16.1
Râmnicu Vâlcea	19.6

On June 4th (Table 2), there were seen gusts of 10-14 m/s at noon hours at the Polovragi weather station, which caused windthrows and wind brakes on the left bank of the river, nearby heights and *on hill tops* along the valley.

Table 2. Wind on 4th of June 2009

Weather station	Hour	Direction	Max. speed (m/s)	Gust m/s
Padeș - Apa Neagră	13	V	4	
	14	V	2	
Târgu Jiu	13	E	2	
	14	*E*	*3*	8
Polovragi	13	V	10	
	14	VNV	10	14
Târgu Logreşti	13	NV	4	
	14	NV	5	
Râmnicu Vâlcea	13	V	4	
	14	VSV	3	10

The pressure of winds on tree heads as well as the variation of wind speed caused by gusts put tree heads in a continuous oscillation which, given the wet, skeletal soil and the superficially developed radicular system, resulted in windthrows and wind brakes (Coșconea, Marinica, 2006). Resonance occurred when the frequency of tree oscillation was equal to that of wind gusts, causing thus even greater damages.

A number of species were affected: beech and particularly spruce and fir. As the conifers were not planted in their usual habitat, their soft and porous wood was quite easy to break down.

CONSEQUENCES

Within the Romani Forestry, in the upper basin of the Luncavăț River, the 2-4 June 2009 event affected:

- a 7.5-ha area;
- 215 m^3 of wood;
- the beech undergrowth and mostly the spruce and fir trees, as they were not planted in their usual habitat;
- trees about 45 years old were uprooted;
- a south-western exposure of the affected versant, which favors the growth of coniferous forests - light loving plants;
- annual growths in this region are up to 5-6 mm (growth rings) as against the normal 2-mm growth in the coniferous habitat. So, it is a rapid growth and the wood is soft and porous.

CONCLUSIONS

1. The 2-4 June 2009 windthrows and wind brakes in the upper basin of the Luncavăț River were *endemic* – a phenomenon occurring annually in undergrowth vegetation, which is related to medium-speed winds and significant damages. It includes isolated windthrows or groups of 5-10 trees as well as massive windthrows affecting a certain kind of undergrowth that covers relatively small geographic areas.

2. It was the following factors which generated this phenomenon:

- meteorological factors
    - air-mass configurations within the tandem Mediterranean cyclone – Icelandic low, which generate significant precipitation amounts in every region of Romania but mostly in the west and south-west (Oltenia);
    - abundant rainfalls diminished the root resistance;
    - strong winds whose action was amplified along the river valley (14 m/s gusts);
- relief characteristics
    - the north-south orientation of the Luncavăț valley and the impact on left-bank trees (south-western exposure), which are exposed to the western and north-western air masses;

- characteristics of the affected woods
    - beech and particularly spruce and fir trees were mostly affected, as these soft- and porous-wood species were not planted in their usual habitat;
    - windthrow trees were around 45 years old;
- types of soil where the affected trees are rooted in

3. This phenomenon affected an area of 7.5 ha and 215m^3 of wood.

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