# THE LODGING OF SNOW LAYER COMPARATIVE ANALYSIS AT EQUAL DISTANCES TO THE LIMIT OF THE FOREST

**Dorog Lucian Sorin***

**University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail: dorogs@yahoo.com*

***Abstract***

*Submission of the snow layer is influenced by meteorological factors of which the most important is the wind. Approach to the topic has become of interest because in the last period it is found that edge enhancement extreme weather phenomena: prolonged dryness in the season of the growing, passages worm periods in winter, dips massive snow in short periods of time. Heavy snow falls have resulted in recent years at serious disturbance of transport especially in areas in which forest vegetation due to lack of snow has been driftbanked in areas where it has encountered obstacles (railways, roads, cities, etc. ).*

*From analyzes conducted in markets of the sample has been found that changes in layer thickness of the snow is high enough in terrain without forest vegetation from forest, while inside the deviations are pretty small with submission in the forest.*

**Key words**: layer thickness snow, variation, the comparative analysis, statistical significans

## INTRODUCTION

Increased incidence of extreme phenomena due to climate change that in our country to have a manifestation powerful (Vajda., 2006). During periods of heavy rain followed by prolonged dryness, intermittent periods relatively warm in winter without of snow followed by periods of rainfall abundant solid lead to major imbalances in relation to agricultural yields, is interfering with transport, and in some areas put seriously endanger the security human (Dorog., 2005). All these lead most of the times the serious implications for human society. Therefore, it requires a knowledge of risk areas and finding ways to combat these phenomena (Virtanen., 2000). The work in front has taken in the study of the snow layer submission under the influence forest vegetation.

It is known that the layer of snow has key role from the point of view energy, hydrological and ecological forest on vegetation. The amount of energy that reaches the ground in winter with the ground covered with snow (Kuusito., 1984) is modified by the amendment albedo, with influence on forest regeneration. On the other hand change albedo lead to melting slower depletion of the snow in the forest, with the result that he or she is able to gradually build large quantities of water thus avoiding leakage on slopes and use of the reserve of water from the soil in critical periods from the point of view of skiers (Koskinen. t. al. 1999). Forest soils with small exceptions stores and make available to plants necessary quantities of water

even during periods of drought with the result that the symptom this factor to be less perceived by forest vegetation (Dorog, 2012).

Increased forecasts in relation to extreme weather phenomena are several measures that to achieve on the one hand population protection against these factors and on the other finding in the long term solutions for blurring these phenomena. These measures will have the following directions:

- The identification and mapping of risk areas
- Implementing concrete measures to reduce the risks and adverse effects produced by these phenomena
- Restoring forest belts destroyed and building new ones where situations imposed
- Imposition of a legislative framework with a view plotting of risk areas and of land-use in the areas in question
- To obtain funds to commit to the work that will require

The forest are natural obstacle in the way wind and snow. Benefit from the influence of the forest is known for a long and now all the more so should we use for the benefit of society.

The shelterbets forestry (Lupe, 1952) determines snow accumulation in the protected space for them in the form of a wave. The width of the snow veil is determined by the width and forestry penetrability blind. So the blind width is narrow width veil of snow is more narrow width and with as long as blind forest is greater than the snow retention on the inside is made on a greater width and width format veil of snow is greater (Scott,. Rouse., 1995).

The shelterbets forestry meet forest from the point of view of distribution in the soil moisture from a dual role: it decreases the action of deleterious wind rose dry with beneficial influence of the land around and increase the quantity of water from the soil by retaining and accumulating a significant layer of snow (Vasilescu, 2007). Inside the forest studied has been found formation of smaller successive waves, usually two, three parallel with the first but of sizes much smaller called using troll lines only (Vasilescu et. al.,2007), which take their turn at a part of the quantity of snow popped out of the wind.

## MATERIAL AND METHODS

The study area is located to the south of city Oradea, forests being situated adjacent Păuşa and Nojorid inhabited areas. Forests of Păuşa is situated adiacent to the county road 671 which acts as a link between city Oradea and south Bihor country.

The study variability layer of the snow in the area built-up areas and Nojorid Păuşa has been carried out during the period 16-18 February 2012

after snowfall abundant in 14 February 2012, which has led to serious road traffic due to not so much quantity of snow but submission of non-uniform.

Markets of the sample they were established each of one transect with a length of 150-200 meters, perpendicularly to the forest edge. On each transect were measured from 5 to 5 meters the thickness of the layer of the snow, resulting in a number of 372 of points measured. Forests in which have been carried out the sample markets that are composed of the basic main species of the *Quercus cerris*, along with the appearing as species of mixture *Carpinus betulus*, *Acer campestre* and *Prunus avium*. Adjacent areas of forests are made up of communal pastures around Nojorid inhabited area and arable land near the Păușa inhabited area.

The thickness of the layer of snow has been influenced by the direction and wind speed. In such weather according to the information in the area, the wind had a speed of 45-50 km/h in the days on which they were carried out measurements and direction of the wind was SV-US.

Processing of the data has been carried out with the program Kyplot. And they have determinations to comparative analysis on the thickness of the layer of snow deposited into the forest at the same distance from the forest edge. Same thing has been carried out and for measurements on the outside forest.

**RESULTS AND DISSCUTIONS**

In the analysis table 1 it is found that without exception by comparing the values of the snow layer thickness the level of significance does not exist, which means that in the forest at the same distance from the edge of the forest the thickness of the layer of snow is approximately uniform with variations extremely low. Differences between environments are extremely small 1-2 centimeters. Only the areas with microrelief surfaces of the forest may accumulate thicknesses in the layer of snow, but which may not be comparable in any case with the values thicknesses as recorded on the outside forest. The level of significance is further evidence of the fact that the forest acts as a barrier in relation to build-up layer of snow. Practically on the inside of the wood at a distance of approximately 10 meters on the edge of the forest the layer of snow is practically uniform.

The second table shows compared variation in thickness of the snow layer deposited at different distances from the edge of the forest. Here it is found that two situations: the first situation in which differences between layer thicknesses of snow are extremely high in close proximity of forest up to 10-15 meters in front of the edge of the forest, and the second situation is at distances greater than 15 meters, where according to table 2 differences are insignificant.

The analysis of first situations found the layer of snow is to be lodged unevenly in close proximity of forest at distances of between 0-15 meters in front of the edge of the forest. In this area the masses of air in contact with the forest have a slight movement ascending to overcome the bulky forestry were made, and in the area of forest proximity to accumulate a layer more consistent with snow. It is important to know this, because the action benefits of the forest can be used in the protection of the means of communications, and the built-up areas.

The situations where differences between the thickness of the layer of snow on the inside and the outside forest are hugely significant it has been found that part of snow has been driven by the wind and deposited in other areas. From the outside forest microrelief have role of accumulate inside them the snow that is done away by winds so that in the areas highest the layer of snow is reduced or even missing. In the forest the amplitude of variation in the thickness of the snow layer is much reduced front to the outside forest, owing to the effect of the protection that exercise forest vegetation.

The relief land is extremely important on the submission of the snow layer on the outside forest. From the observations of the land has been found that where there is a ditch or land is curling extremely large differences in the thickness of the snow layer on extremely small distances. Plant residue remaining on the field influences, and they deposit snow and stability over time, because it is more difficult done away by the wind.

*Tabel 1*

**Comparative analysis of variations in layer thickness of the snow in the forest for the distances analyzed**

| Dist. | Comparing layer thickness of the snow in the forest. The level of significance | | | |
|---|---|---|---|---|
| | The measuring distance (meters) | | | |
| | 5 | 10 | 15 | 20 |
| 0 | 1.1089 N.S. (P>0.05) | 1.9527 N.S. (P>0.05) | 1.9527 N.S. (P>0.05) | 0.7473 N.S. (P>0.05) |
| 5 | - | 0.8437 N.S. (P>0.05) | 0.8437 N.S. (P>0.05) | 0.3616 N.S. (P>0.05) |
| 10 | - | - | 0 N.S. (P>0.05) | 1.2054 N.S. (P>0.05) |
| 15 | - | - | - | 1.2054 N.S. (P>0.05) |
| - | 25 | 30 | 35 | 40 |
| 0 | 0.3616 N.S. (P>0.05) | 0.1205 N.S. (P>0.05) | 0.1928 N.S. (P>0.05) | 1.0848 N.S. (P>0.05) |
| 5 | 0.7473 N.S. (P>0.05) | 0.9884 N.S. (P>0.05) | 0.9161 N.S. (P>0.05) | 2.1938 N.S. (P>0.05) |
| 10 | 1.5911 N.S. (P>0.05) | 1.8322 N.S. (P>0.05) | 1.7599 N.S. (P>0.05) | 3.0376 N.S. (P>0.05) |
| 15 | 1.5911 N.S. (P>0.05) | 1.8322 N.S. (P>0.05) | 1.7589 N.S. (P>0.05) | 3.0376 N.S. (P>0.05) |
| 20 | 0.3857 N.S. (P>0.05) | 0.6268 N.S. (P>0.05) | 0.5544 N.S. (P>0.05) | 1.8322 N.S. (P>0.05) |
| 25 | | 0.2410 N.S. (P>0.05) | 0.1687 N.S. (P>0.05) | 1.4465 N.S. (P>0.05) |
| 30 | | | 0.0723 N.S. (P>0.05) | 1.2054 N.S. (P>0.05) |
| 35 | | | | 1.2777 N.S. (P>0.05) |
| - | 45 | 50 | 55 | 60 |
| 0 | 0.1446 N.S. (P>0.05) | 0.3857 N.S. (P>0.05) | - | - |
| 5 | 1.2536 N.S. (P>0.05) | 1.4947 N.S. (P>0.05) | - | - |
| 10 | 2.0974 N.S. (P>0.05) | 2.3385 N.S. (P>0.05) | - | - |
| 15 | 2.0947 N.S. (P>0.05) | 2.3385 N.S. (P>0.05) | - | - |
| 20 | 0.8920 N.S. (P>0.05) | 1.1331 N.S. (P>0.05) | - | - |
| 25 | 0.5062 N.S. (P>0.05) | 0.7473 N.S. (P>0.05) | - | - |
| 30 | 0.2651 N.S. (P>0.05) | 0.5062 N.S. (P>0.05) | - | - |
| 35 | 0.3375 N.S. (P>0.05) | 0.5786 N.S. (P>0.05) | - | - |
| 40 | 0.9402 N.S. (P>0.05) | 0.6991 N.S. (P>0.05) | - | - |
| 45 | | 0.2410 N.S. (P>0.05) | - | - |

*Tabel 2*

**Comparative Analysis of variations in layer thickness of the snow from the outside forest for the distances analyzed**

| Dist. | Comparing layer thickness of the snow from the outside forest. The level of significance | | | |
|---|---|---|---|---|
| | The measuring distance (meters) | | | |
| | **5** | **10** | **15** | **20** |
| **0** | *** -11.2925 (P<=0.001) | *** -10.4282 (P<=0.001) | *** -8.9395 (P<=0.001) | *** -8.8275 (P<=0.001) |
| **5** | - | N.S. 0.8643 (P>0.05) | N.S. 2.3529 (P>0.05) | N.S. 2.4649 (P>0.05) |
| **10** | - | - | N.S. 1.4885 (P>0.05) | N.S. 1.6006 (P>0.05) |
| **15** | - | - | - | N.S. 0.1120 (P>0.05) |
| **-** | **25** | **30** | **35** | **40** |
| **0** | *** -8.7955 (P<=0.001) | *** -8.5794 (P<=0.001) | *** -9.4918 (P<=0.001) | *** -6.3785 (P<=0.001) |
| **5** | N.S. 2.49700 (P>0.05) | N.S. 2.7130 (P>0.05) | N.S. 1.8007 (P>0.05) | *** 4.9139 (P<=0.001) |
| **10** | N.S. 1.6326 (P>0.05) | N.S. 1.8487 (P>0.05) | N.S. 0.9363 (P>0.05) | ** 4.0496 (P<=0.01) |
| **15** | N.S. 0.1440 (P>0.05) | N.S. 0.3601 (P>0.05) | N.S. -0.5522 (P>0.05) | N.S. 2.5610 (P>0.05) |
| **20** | N.S. 0.0320 (P>0.05) | N.S. 0.2480 (P>0.05) | N.S. -0.6642 (P>0.05) | N.S. 2.4489 (P>0.05) |
| **25** | | N.S. 0.2160 (P>0.05) | N.S. -0.6962 (P>0.05) | N.S. 2.4169 (P>0.05) |
| **30** | | | N.S. -0.9123 (P>0.05) | N.S. 2.2008 (P>0.05) |
| **35** | | | | N.S. 3.1132 (P>0.05) |
| **-** | **45** | **50** | **55** | **60** |
| **0** | *** -6.6986 (P<=0.001) | *** -6.2905 (P<=0.001) | *** -7.58704 (P<=0.001) | *** -6.5866 (P<=0.001) |
| **5** | *** 4.5938 (P<=0.001) | *** 5.0020 (P<=0.001) | * 3.7054 (P<=0.05) | *** 4.7058 (P<=0.001) |
| **10** | * 3.7294 (P<=0.05) | ** 4.1376 (P<=0.01) | N.S. 2.8411 (P>0.05) | * 3.8415 (P<=0.05) |
| **15** | N.S. 2.2408 (P>0.05) | N.S. 2.6490 (P>0.05) | N.S. 1.3525 (P>0.05) | N.S. 2.3529 (P>0.05) |
| **20** | N.S. 2.1288 (P>0.05) | N.S. 2.5370 (P>0.05) | N.S. 1.2404 (P>0.05) | N.S. 2.2408 (P>0.05) |
| **25** | N.S. 2.0968 (P>0.05) | N.S. 2.5050 (P>0.05) | N.S. 1.2084 (P>0.05) | N.S. 2.2088 (P>0.05) |
| **30** | N.S. 1.8807 (P>0.05) | N.S. 2.2889 (P>0.05) | N.S. 0.9923 (P>0.05) | N.S. 1.9927 (P>0.05) |
| **35** | N.S. 2.79312 (P>0.05) | N.S. 3.2012 (P>0.05) | N.S. 1.9047 (P>0.05) | N.S. 2.9051 (P>0.05) |
| **40** | N.S. -0.32013 (P>0.05) | N.S. 0.0880 (P>0.05) | N.S. -1.2084 (P>0.05) | N.S. -0.2080 (P>0.05) |
| **45** | | N.S. 0.4081 (P>0.05) | N.S. -0.8883 (P>0.05) | N.S. 0.1120 (P>0.05) |
| **50** | | | N.S. -1.2965 (P>0.05) | N.S. -0.2961 (P>0.05) |
| **55** | | | | N.S. 1.0004 (P>0.05) |

## CONCLUSIONS

The comparative analysis of the thickness of the snow layer of the forest at the same distance from the edge of the forest has been found lodging a uniform layer of snow. From the analysis level of significance between the various thicknesses of layer of snow of the forest measured at equal distances from the forest edge has been found to have no exceptions insignificant differences between the values compared. Differences between environments at different distances calculated are extremely small 2-3 centimeters. Forest, is to be deducted and from the measured and calculated in the tables above acts as a barrier that prevents accumulation of snow with adverse effects well known.

Analysis of deposit layer of snow from the outside shows that at the contact area of the forest with other fields of farming is carried out in general on distances of 10-15 meters acumulation of snow. The effect must be known as regards location curtains forest protection for the protection of the means of communications, and the built-up areas.

Differences between the thickness of the layer of snow measured to the outside forest are extremely high. Causes that have led to this situation are multiple and generally keep the concerted action of the factors. Of these the first rank are: the direction and wind speed, as well as the orientation of the massive front edges to it. Of the factors of a rank secondary can remember here: the density and the age stand, the existence or absence bushes, relief terrain and obstacles existing in the field.

Need thoughts in the medium and long term strategies for mapping of areas with the potential for acumulation of snow and the implementation of effective measures to reduce the risk should become priority national reconstruction with a view to curtains degraded forest and the location new ones where conditions demand it because in the last period has found an increase in the incidence extreme weather phenomena.

Analysis of risk areas and the application of the appropriate measures will be necessary to constitute in national priorities to reduce adverse effects produced by extreme weather phenomena.

## REFERENCES


1. Dorog S., 2005, Avantajele sistemelor agrosilvice, Analele Universităţii din Oradea, Fascicula Silvicultură vol. X, pag. 71-76 ISSN. 1453-9489
2. Dorog S., 2012, The effect of the forest vegetation on snow deposition: case study, the forest at the fringe of Nojorid and Pausa localities, Research Jurnal of agriculture science vol. 44 (3) 1-908,University of Agriculture sciences and veterinar medicine of the Banat, Timişoara, ISSN 2066-1843 pag. 186-191

3. Koskinen J., S. Metsamaki, J. Grandell, S. Janne, 1999, Snow monitoring using radar and optical satellite date, Remonte Sensing and Environment 69(1), pag. 16-29
4. Kuusisto E., 1984, Snow acumulation and snow melt in Finland, Publication of the Water Research Institute 55 Helsinki, pag. 149
5. Lupe, I., 1952: Perdele forestiere de protecţie şi cultura lor în câmpiile Republicii Populare Române. Editura Acad. R.P.R., Bucureşti, 269 p.
6. Scott P.A., W.R . Rouse, 1995, Impacts of inceased winter sow cover on upland tundra vegetation: A case example. Climate Research 5(1), pag. 25-30
7. Vajda Andrea, A. Vanalainen, P. Hanninen, R.Sutinen, 2006, Effect of vegetation on snow cover at the Northen Timberline: A case study in Finnish Lapland, pag. 197-207
8. Vasilescu, M. M., 2007: Efecte ale perdelelor forestiere de protecţie asupra culturilor de grâu. În: Lucrările sesiunii ştiinţifice bienale cu participare internaţională, Pădurea şi Dezvoltarea Durabilă, Braşov, 27-28 octombrie 2006, pp. 397-402.
9. Vasilescu, M. M., C. Tereşneu, B. Candrea, 2007: Research on the effects of forest shelterbelts on agricultural crops. În: Proceedings IUFRO Conference on Forest Landscape Restoration, Seul, 17-19 mai 2007, pp. 257-258.
10. Virtanen R., 2000, Effects on above-ground biomass on a mountain snowbed, NW Finland, Oikos 90, pag. 295-300.