

## The Dynamics of Forest Areas in the Vâlsan Basin

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### Abstract

This case study refers to forest area dynamics within the Vâlsan Basin, situated between his affluents: Mierlei Valley and Bunești Valley in 1904-2004 period. The dynamics was shown by maps on a temporal scale especially in reference years as 1904, 1973, 1981, 1994, 2004. Forest cover from our study area has been decreased substantially because of the impact of human activities. We can conclude at the end of our paper that forest ecosystems had lost the natural equilibrium, and barely can realize the protective and hydrological function, in the context of declaring our study a natural reserve.

**Keywords:** *forest dynamics, forest ecosystems, V.R.B., forest management plans*

### Rezumat. Dinamica unor suprafețe forestiere în bazinul Vâlsan.

Studiul de caz se referă la dinamica suprafețelor forestiere din Bazinul Râului Vâlsan, între afluenții acestuia: Valea Mierlei-Valea Bunești, în perioada 1904-2004. Dinamica a fost evidențiată cartografic pe paliere de timp astfel: 1904, 1973, 1981, 1994, 2004. Suprafața forestieră din sectorul analizat s-a restrâns foarte mult odată cu creșterea presiunii umane. În consecință ecosistemele forestiere s-au îndepărtat de echilibru, iar pădurea nu-și mai poate îndeplini funcția de protecție și hidrologică în contextul în care regiunea analizată a fost declarată rezervație mixtă.

**Cuvinte-cheie:** *dinamică forestieră, ecosistem forestier, B.R.V., amenajament silvic*

### INTRODUCTION

From many studies and researches in this area was proved the fact that human impact is not the only cause that produces changes in forest ecosystems.

Forest dynamics means changes produced in: composition, structure and forest functions. Forest dynamics includes processes which produce at different scales, changes in space and time. There are two major concepts referring to forest dynamics. First is about succession of vegetation – Clements (1916), followed by Gleason's ideas (1917-1939), Odum (1969) and Davis (1983). This theory had proved that glacial and interglacial events produce changes in species distribution. The second concept refers to vegetation dynamics and is related more to forest sciences which propose that forest must be have appropriate management plans for maximizing the benefits. Nowadays there is a new challenge for ecologists and foresters.

The challenge is about analyzing forest dynamics as a result of global changes and changes in land use as the main causing factors.

Global changes will affect forest ecosystems on the level of composition and structure.

The consequences will manifest, mainly upon: catchment river's water inputs (precipitations and supply), erosion, forest resources, biodiversity and landscape.

Nowadays forest dynamics is analyzed mainly with GIS (Geographic Information System) which helps us to create models of forest areas dynamics (Terradas J., 2005 p. 526, 527, 529).

Land use in Subcarpathian sector of the Vâlsan river was represented in retrospective mapping (Gabriela Osaci-Costache, 2007, p. 58). In 2002 Gabriela Osaci-Costache, by planimetry, had realized a partial reconstruction of Vâlsan river's forest areas. In Specht map (1790-1791) forest had covered a main part of Argeș hills at the end of 18th century. Argeș -Vâlsan interfluvium was covered more than 50 %. The forests from Argeș hills were represented on a grey background on our map, in distribution on our study area and alongside land use on Southern Romania Charta (1864) on the basis of Szatmary map. Forest planimetry resulted that Argeș- Vâlsan interfluvial space had larger forest areas than Vâlsan - Doamnei River interfluvial space. The dominant species which were specific of forest ecosystems from catchment area were represented on thematic map - Forest Map (scale 1:200 000 colored) drawn in 1900 by the State Forestry Service (Gabriela Osaci-Costache, 2002 p. 146-148). With an area of 35,800 ha forested, the Basin of Vâlsan was in 1974 forested at a rate of 51 % (V. Dinu, 1974 p. 247). Anthropogenic intervention in Subcarpathian sectors, generally deforestation, increased the degree of

slopes instability and allowing intense modeling of the relief (Bălțeanu et al, 1976).

The aim of this paper is mapping and analyzing the forest dynamics in Vâlsan River Basin (V.R.B.) between his affluent Mierlei Valley and Bunești Valley. Our study area had particular natural conditions, and deforestation was the main cause of clogging the Vâlsan reservoir and the effect was direct on raising the solid charges of the river.

The forest has a multifunctional role. In the V.R.B. an increasing hydrological role is highlighted, and also the role in land protection. Being situated on the upper slopes of the hydrological regime, the forest ecosystems influence Vâlsan Basin as follows: regulate the liquid and the solid flow; reduces the processes of soil erosion.

#### Study area

The hydrographic basin (Fig.1.) of the River Vâlsan (348 km<sup>2</sup>) is geographically disposed in the central part of the Fagăraș Mountains (Geografia României, vol. I, 1983). The vegetation belongs to the nemoral zone (Călinescu et al, 1972) and is determined by interrelation of the environments' components: landforms, climate, hydrographic, soils. The annual average rainfall amounts to 900 mm/year, and the average temperature varies between 7 and 8<sup>0</sup>C. There are acid brown soils.

#### DATA AND METHODS

The data used in the analysis of the forest dynamics, map and graphics development have been taken from the Mușătești Forest Association, Production Unity III (Mușătești). The maps have been created with the help of ArcGIS 9.3 software. This study was realized on the basis of field observation in 2009 and 2010. The forest dynamics between 1973 - 2004 was made using the maps from forest management plans at the scale of 1: 20,000.

Every map was georeferenced in Global Mapper 9 with the scale 1:25,000 from 1981 software, following the topographic map.

The projection was made in Stereo 70. After this phase we have vectorised the forest areas on every map. This is how we developed maps of the wooded areas for 1973, 1994, and 2004.

For drawing the forest map from 1904 was used the information from the maps in Lambert conic projection (Master Plan Drawing, scale 1:20,000).

In the Adobe Photoshop 9.0 software the "margin" errors have been eliminated, and afterwards the two sketches (Cerbureni, Corbi) have been united. With the help of ArcGIS 9.3., we have drawn the maps representing the forest areas and the

exploitation of land in 1904. For assessing vegetation dynamics was calculated the forest area coverage index represents the forest cover percentage from total surface of a territory unit (Ionescu & Săhleanu., 1989). Data used for calculating this index were given by Statistics Argeș County Direction.

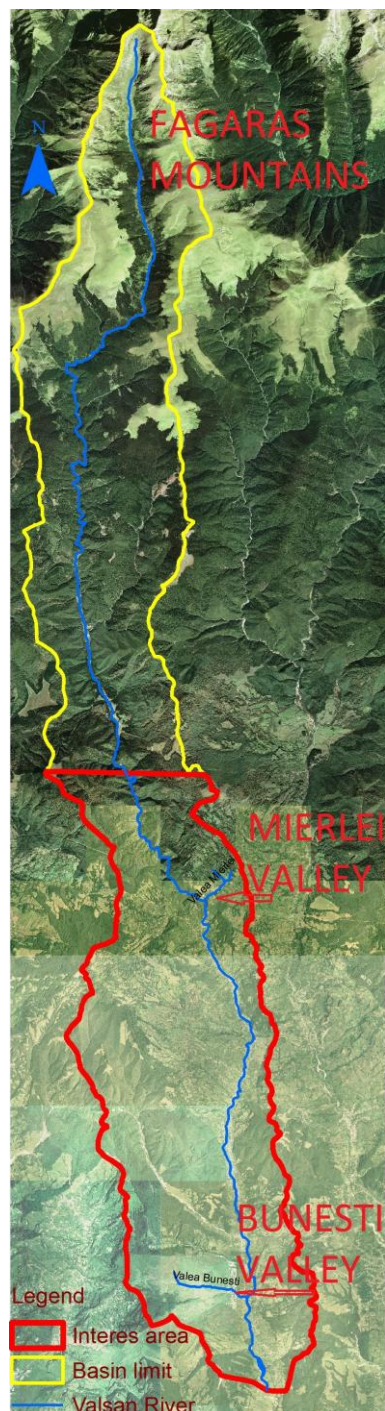


Fig. 1 Vâlsan River Basin – Study area

#### DISCUSSIONS

The Anthropogenic factor induced a continue pressure upon forest ecosystems from V.R.B. The

exploitation of the wood was the main cause of deforestation.

The hydrological role of the forest is extremely important for the Vâlsan river because the forest ecosystems directly affected the solid and the liquid flow of the V.R.B. The removal of the vegetation from the slopes generates an increasing in sliding processes and an acceleration of the solid flow. Solid flow grown causes rapid silting in the reservoir. We could consider that silting of the lake and lower fluid flow are the main problems in the V.R.B.

The influence and their effect is existing ecosystems for the species *Romanichthys valsanicola* (Bănărescu et al., 1957) – minor bed of the river Vâlsan.

The dynamics of the vegetation was analyzed gradually. The maps realized show the dynamic of the vegetation on a period of 100 years.

Until 1948 every owner tried to manage his own forest, according to the demands of the market, respecting more or less the forest legislation which was in force until that date (1948).

The forestry dynamics of the basin was analyzed starting with 1904. In 1904 (Fig.2), the forest covered more than 50% of the study area.

Vâlsan affluent (Robaia, Valea lui Maș) were properly afforested. Robaia affluent was afforested 100%. In this map were more beech wood, beech in combination with hornbeam and oak tree. The landscape was in balance, similar to the initial one. Surfaces uncovered with vegetation represented agricultural lands.

Land use was represented on the the map from 1904 which highlights that forest areas had been decreasing in past decades for extending human settlements Mușătești, Brăduleț, Valea Faurului. The forests belonging to various individuals were small, up to a few hundred hectares. The common forests belonged to two families (Mușătești Forest management plans, 2004).

In 1904 compared to 1973 there took place deforestation in 20 % from whole surface (Fig. 3.). 2400 hectares were deforested. If in 1904 the forest was on an area of study of 52 %, in 1973 the forest took only 29 % of the area. The main cause for deforestation was wood exploitation with the purpose of selling and extending construction business.

The purpose of deforestation was the construction of the recovery hospital Brădet, built in 1975 in the area called today Baile Brădet. In 1973, in the area of Braduleț, Musatesti, Valea Faurului the human pressure determined the changing of the usage of fields compared to 1904. The forests were replaced by meadows and grass fields. In this period

of time there also took place planting of trees in the area Bunești Valley.

In the period of 1904-1973 (Fig. 3) the largest deforestation was north to the area of study on both sides of the river close to the town of Brădet.

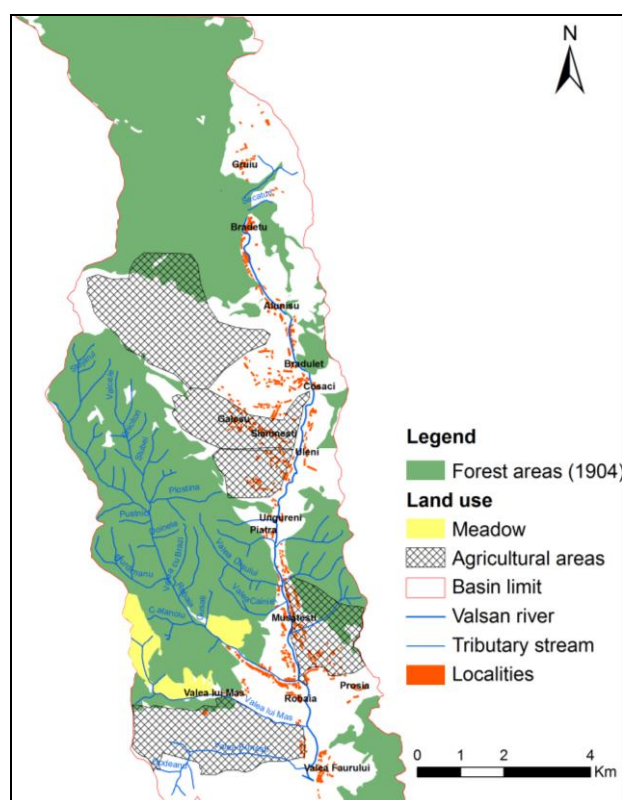


Fig. 2. The Vâlsan River Basin Land use (1904)

In the north-east of Musatesti and Faurului Valley there took place significant deforestations. Small areas were deforested in the valleys of Maș and Robaia.

The forests belonging to physical personae were inadequately managed. The resulted wood was used for personal purposes (constructions, heating system of houses and buildings) and for selling purposes.

Following the deforestation the fields were used for cattle. In this period most of the forest was turned into agricultural fields.

An increase in the foresting process was registered between 1973-1981 (Fig. 3). There took place forestation on an area of 700 hectares (Mușătești Forest management plans, 2004).

Between 1981-1994 (Fig. 3.) largest deforested area was in northeastern town of Mușătești. During this period the area occupied by forests decreased by 7 %. Important deforestation has been made on the right side of the Vâlsan river between the villages Brădet-Mușătești. In the south area of Brădet and until the Alunișu villages the slopes were heavily grubbed.

The forest fragmentation was associated with the reduction and fragmentation of forest plots. Native forest species in the basin that formed were replaced by species with more economical value.

Between 1973 – 1981 (Fig. 3) the percentage occupied by the forest increased from 29% (1973) to 36% (1981).

Between 1973, 1994, 2004 the study area did not suffer any major changes in forest areas from Vâlsan catchment. In this period the forest areas declined in favor of spruce fir, acacia, ash and other species decreased only with 0.36 % (1994), and with 0.53% in 2004 (Figure 3 and 4).

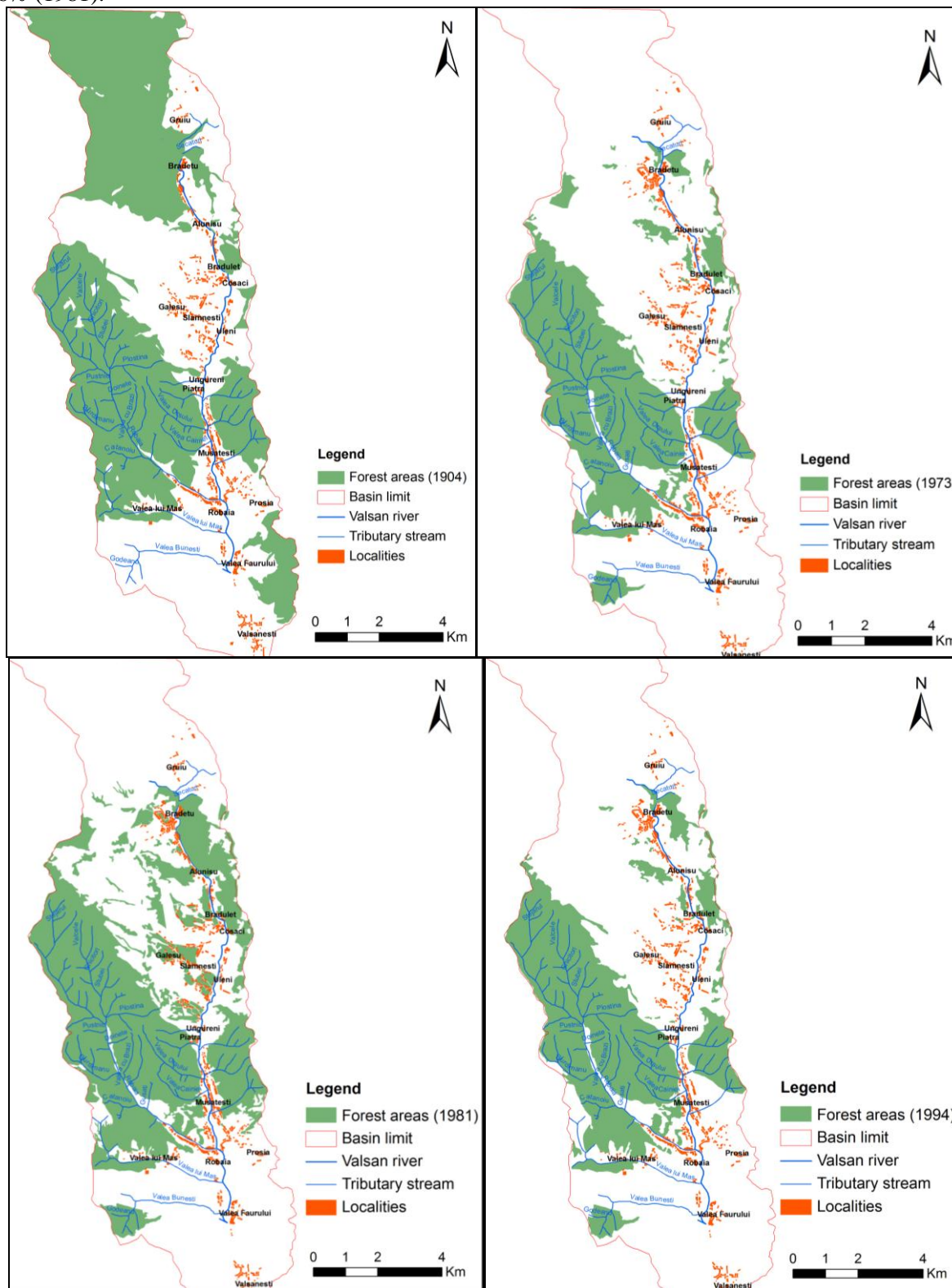


Fig. 3. The dynamics of forests area between 1904 and 1994 in the V.R.B.

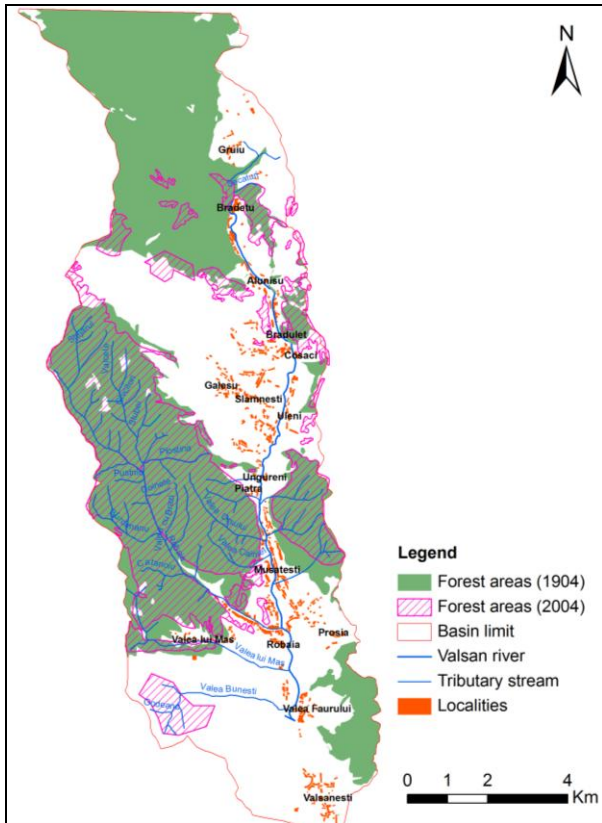


Fig. 4. Forests area in 2004 compared to 1904 in V.R.B.

In 2004 compared to 1904 there took place deforestation in 21 % from whole surface (Fig.4.).

Beech, one of the species fundamentally natural, in 2004, had reduced in area, because of the spruce fir, ash tree and acacia extension (Fig. 5).

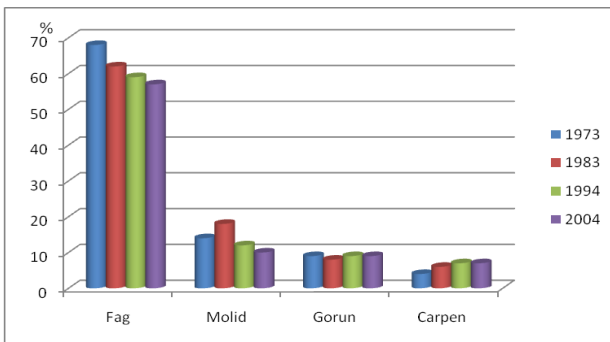


Fig. 5. Vâlsan Basin Valley-Valley Mierlei – Valley Bunești - proportion of species

In Figures 6 and 7, from data analyses we can observe that it happens a decreasing of forest areas at catchment level of the river and production units.

Forest area coverage index was calculated for Mușătești and Brăduleț. The two reference years were 1960 (Table 1) and 1995 (Table 2). This time interval was used to evaluate the dynamics of forest areas in the two localities.

By assessing the statistical data from 1960, the value of the forest area index coverage in Mușătești

city was 56% indicating a relatively stable environment (according to the classification of Ionescu & Sahleanu, 1989).

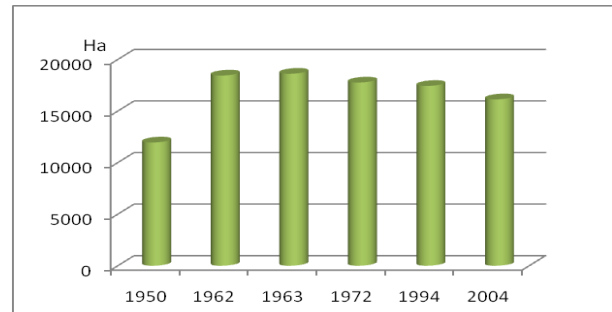


Fig.6. The dynamics of the forested areas in V.R.B. (data source: Mușătești Forest management plans, 1950-2004)

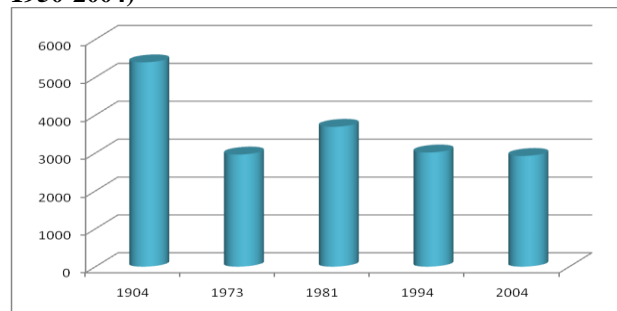


Fig.7. The dynamics of forest areas Mierlei Valley-Bunești Valley (data source: Mușătești Forest management plans, 1950-2004)

Table 1  
Forest area coverage index Brăduleț and Mușătești (1960)

Locality	Total area (ha)	Forest area (ha)	Forest area coverage index (%)
Brăduleț	4852	2407	49,6
Mușătești	9502	5304	55,81

Source: Argeș County Statistics

Table 2  
Forest area coverage index Brăduleț and Mușătești (1995)

Locality	Total area (ha)	Forest area (ha)	Forest area coverage index (%)
Brăduleț	4852	2126	43,81
Mușătești	9502	5574	58,66

Source: Argeș County Statistics

The small town of Brăduleț falls into the same stable, forest area coverage index value for the same year being 50 %. For Brăduleț in this 35 years (1960-1995) the forest area index coverage decreased by 6 %.

According to the classification of A. Ionescu, V. Sahleanu, 1989 if there is the same dynamics of the vegetation (with a decrease in this indicator of 6% in 35 years) in the next 35 years (2030) the index will have a value of 39%. If you keep the same pace of deforestation in this town – in the future the area will be strongly affected by the deforestation and other land use change activities.

At present (Fig. 8.) the surface of Mușătești is occupied mostly by pastures and meadows with a percentage of 51% of the total area, and forests occupy only 8%. In the future on the area of the settlement geomorphologic processes (especially gullying and torrential) will occur as well as spring floods and other cumulative processes, because the forest has been slowly cleared and its protective role in the environment has been eliminated. The purpose of forest deforestation was not represented by the expansion of the inhabited areas or the wood exploiting area. The forest was replaced by agricultural land.

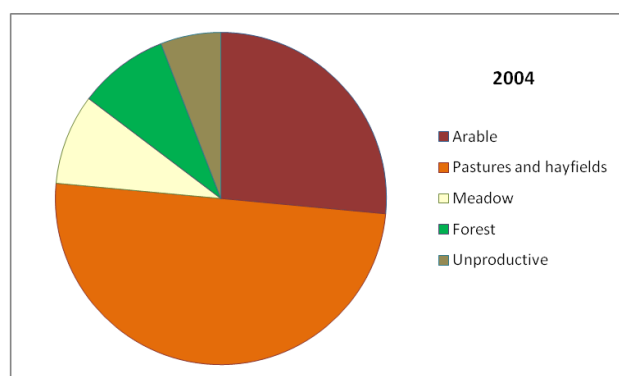


Fig.8. Mușătești common land use (2004).  
(Data source: 1950 to 2004 forest plan).

## CONCLUSION

Map interpretation represents a direct modality for assessing the forest dynamics in Vâlsan Basin in the sector Mierlei valley and Bunești Valley. The analyses showed that the forest occupied the biggest area in 1904, forest area represented in over 50 % of land uses classes.

The forested areas have decreased progressively since 1904 and concurrently were made several plantations of the deforested areas. The greatest deforestations occurred after 1904 until 1973.

The extension of human settlements induced deforestation processes, the main cause being wood exploitation for economic purposes.

Deforestations were increasing almost throughout the analyzed temporal scale, exception was for 1950, 1962, 1973-1981; when forest area increased with 7%. Important afforestations were made in 1950 and 1962 (6590 hectares).

In the period between 1973 and 2004 the forest did not register a clear dynamic. Although the Forestry authority that after 1950 the forests which belong to this forestry had had an efficient management based on modern principles, a major part of them was actually deforested in that period. The deforestation caused environmental problems such as: accelerated geomorphologic processes

(collapses, creeps, slides), increase in the solid flow volume and disturbances of the relationship vegetation- river flow. In the future deforestations will produce a further increase in the solid flow volume which will eventually completely clog the lake Vâlsan and make it inoperable. Beside this environmental impact, the alteration of the water quality will cause the extinction of the specie *Romanichthys valsanicola* - is dedicated to Romania and Vâlsan.

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