

## GOAT WILLOW (*SALIX CAPREA* L.) FROM THE CURVATURE SUB-CARPATHIANS

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### ABSTRACT

The present article has studied data from forest management plans realized for forest district forests located in the Curvature Sub-Carpathians during 1999-2006. We have extracted from them only the data regarding the goat willow stand elements that enter in the composition of management parcels. The purpose of this article is to analyse the main qualitative stand characteristics (age), the tree's structural characteristics (consistency, composition), as well as stational characteristics (altitude, slope, soil type). The total surface occupied by this species is of 119.1 ha, with the highest percentages recorded in Cislău, Slănic and Vinilă Vodă Forest Districts. These stands are present at altitudes between 150 m and 4100 m, with an average of 550m. Slope is the main relief characteristic for these stands, occupying 42% of the total stand surface. Our research has revealed that goat willow stands have ages between one and 70 years, while their consistency is appropriate (0.7-0.8). However, some barreland stands are also present (0.4-0.5). The most representative forest type is 9112. Goat willow is one of the first flower plants that blooms in the spring, generating high quantities of pollen and nectar as a food source for bees, insects or birds.

**KEY WORDS:** goat willow, production class, age, forest type.

### INTRODUCTION

*Salix* Genus includes 330-500 species and over 200 hybrids that are largely distributed in Africa, America, Europe and Asia.

Goat willow is commonly used in agriculture fields from Northern Europe. Here, its main purpose is to protect fields from winds so it is mainly planted in ditches located between fields. In addition, the species can be used in producing bioenergy as its growing rates are very rapid (Ahmed *et al.* 2011). However, the specie's economic value is reduced. Its scientific name (“caprea”) means goat and it derives from the fact that its leaves were used as forage for goats (Enescu *et al.* 2016)

In Romania, the species appears frequently in the hill area, is common for the mountain area and rarely descends to the plain. From an ecologic perspective, Goat willow is unpretentious towards stational conditions, especially climate, as it tolerates harsh climates from north or subalpine areas (Clinovschi, 2005).

Extracts from Goat willow are traditionally used in popular medicine and contain numerous active compounds (salicin) and 322 secondary metabolites. As such,

the extracts can be used as astringent, antiseptic, eye tonic, antipyretic, analgesic and cardiogenic (Tawfeek *et al.* 2021; Enescu *et al.* 2016; Alexan & Ianovici, 2018). Studies show that *Salix caprea* flowers have a significant antioxidant and hepatoprotective property (Sarwar *et al.* 2006; Ciobanu & Ianovici, 2018)

During the last decades, extracts from goat willow buds have been used in treating disorders caused by oxidative stress (Calorio *et al.* 2017). Goat willow inhibits skin carcinogenesis (Sultana, 2004).

In Italy, the species is cultivated as an ornamental plant. In China and Persia, the tree was considered a symbol of immortality. Antic Greek and Roman writers knew the plant. Herodotus mentioned it, Theophrastus identified two types, while Dioscorides described its astringent properties (Akbar Shahid, 2020).

Goat willow is present even in less polluted areas, being used globally for its capacity to extract heavy metals such as Cd and Zn (Likar *et al.* 2004; Unterbrunnner *et al.* 2006; Enescu *et al.* 2016)). Furthermore, the species is melliferous, generating a honey production of 150-200 kg/ha (Çelemlı, 2012; Jürgens *et al.* 2014; Enescu *et al.* 2016).

Forests from the Curvature Sub-Carpathians offer numerous benefits, such as: biodiversity (Turcu *et al.* 2019; Dinca & Breaban, 2020; Timis-Gansac *et al.* 2020; Dinca & Vechiu, 2020; Cantar *et al.* 2021), non-wood forest products (Blaga *et al.* 2018; Vechiu *et al.* 2019; Tiwary *et al.* 2020), medicinal plants (Vasile *et al.* 2018), forest fruits (Tudor *et al.* 2019; Enescu *et al.* 2020; Tudor *et al.* 2021), mushrooms (Dinca *et al.* 2016), animals (Ciontu *et al.* 2020; Crisan *et al.* 2020), forest soils (Edu *et al.* 2013; Crisan *et al.* 2020; Dinca *et al.* 2020) and many more (Ianovici *et al.*, 2015).

#### **MATERIAL AND METHOD**

The present study was created on data from forest management plans realized for forests from forest districts located in the Curvature Sub-Carpathians (10 forest management plans realized during 1999-2006 – \*\*\*Forest management plans). Data regarding the elements of Goat willow stands were then extracted from these plans that contain descriptions of all environments and stand characteristics. With the help of Excel, we have firstly extracted Goat willow stand elements (146 elements) and then the data related to them.

The following stand and environment characteristics corresponding to the species were analysed: distribution, altitude, relief forms, soils, forest types, mixture, stand structure, current growth and production class.

#### **RESULTS AND DISCUSSION**

Goat willow is present in all 10 forest districts from the studied area, occupying a surface of 119,10 ha. The areas with an increased presence for this

species are Cislău (35,30 ha), Slănic (20,10 ha) and Vintilă Vodă Forest Districts (17,50 ha). They are followed by a group of forest districts in which Goat willow has an average distribution: Parscov (11 ha), Pucioasa (9 ha) and Văleni (7 ha). On the other hand, a reduced distribution is present in Vidra (2,8 ha), Dumitrești (2,10 ha) and Moreni (2 ha) (fig.1).

Among the stational characteristics specific for Goat willowstands, the following elements were analysed: slope, altitude, inclination, exposition and soil type.

**Slope** is the relief form that characterizes these stands, occupying only 42% of the total stand surface (fig. 2).

**The field exposition** specific for these stands is mainly East and South-East (fig.3).

**The altitude** where goat willow appears ranges between 150 m in Parscov and 1400 m in Pucioasa. The average altitude for all parcels where goat willow is present is of 550 m. Generally speaking, we can observe that the altitude characteristics for this species range between 101-500 m (fig. 4).

In regard to the characteristics of Goat willow stands, we have analysed the following elements: forest type, stand age, consistency, tree structure and production class.

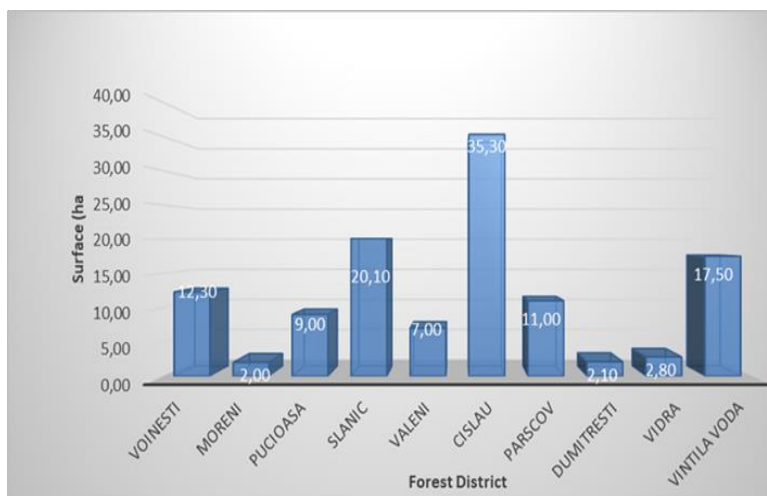


FIG. 1. The surface occupied by *Salix caprea* L.

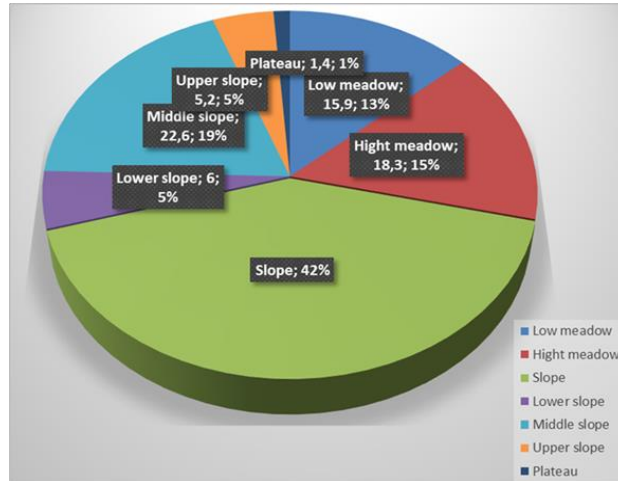


FIG. 2. Relief forms characteristic for Goat willow



FIG. 3. Field exposition.

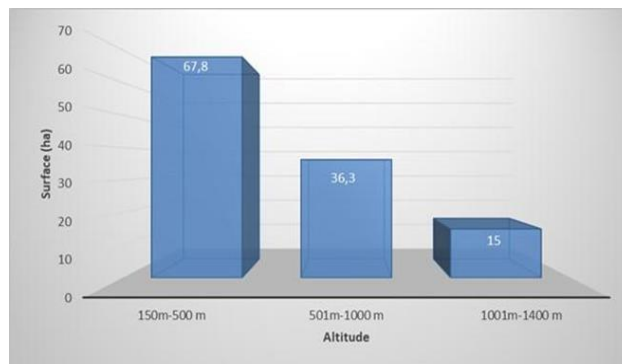


FIG. 4 . Altitude ranges of Goat willow stands.

**The forest types** in which Goat willow appears are: 9112 (21,8 ha), mixed common beech stand from the hill area; (8,2 ha), cliff holm stand (6,8 ha), hill tug with holm and common beech of average productivity (6 ha), resinous and common beech mixtures on skeletal soils (6 ha), hill common beech stands on skeletal soils with mull flora 4212 (5,2 ha) and fir-common beech stand with mull flora and average productivity (4,9 ha).

**Stand age** is young, ranging between 1 and 70 years. In addition, we have noted that 41,40 ha from the total surface are occupied by goat willow with ages between 21-30 years (fig. 5).

**Stand consistency** is appropriate (0.7-0.8). By analysing the graphic, we can see that 32,7 ha are occupied by stands with a consistency of 0.7, while 36 ha are occupied by stands with 0.8 consistency. Furthermore, barrelande stands are also present (0.4-0.5) (fig.6).

**Stand structure** is mainly even-aged (92,1 ha), relatively even-aged (10,8 ha), and relatively uneved-aged (16,20 ha) (fig.7).

**The production class** is inferior (4th class = 29,80 ha; 5th class = 0,40 ha), at most average (3d class = 70,00 ha) (fig.8).

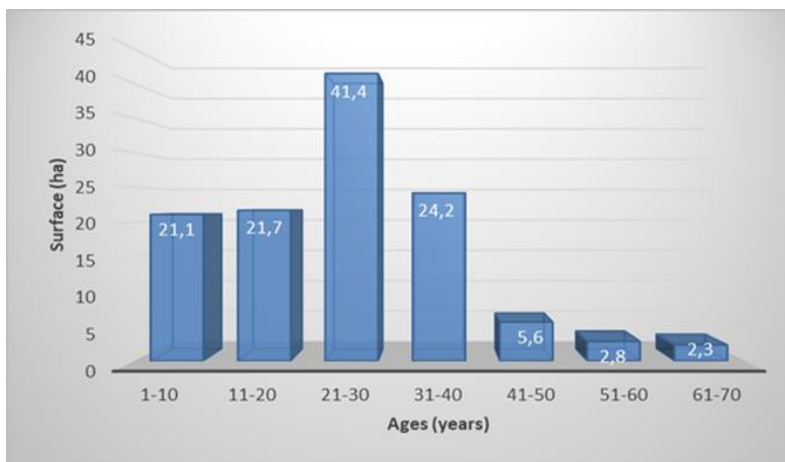


FIG. 5. Age of Goat willow stands.

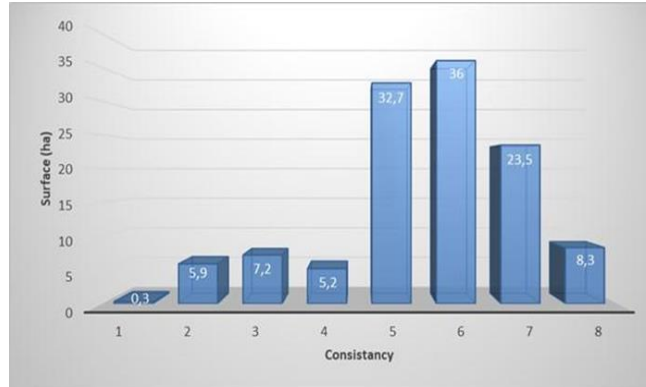


FIG. 6. The consistency of Goat willow stands.

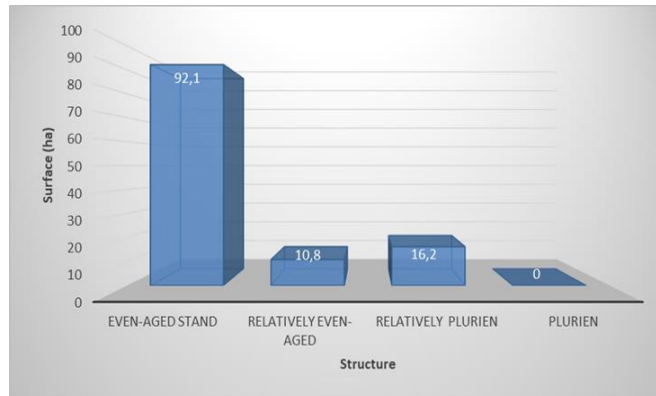


FIG. 7. The structure of Goat willow stands.

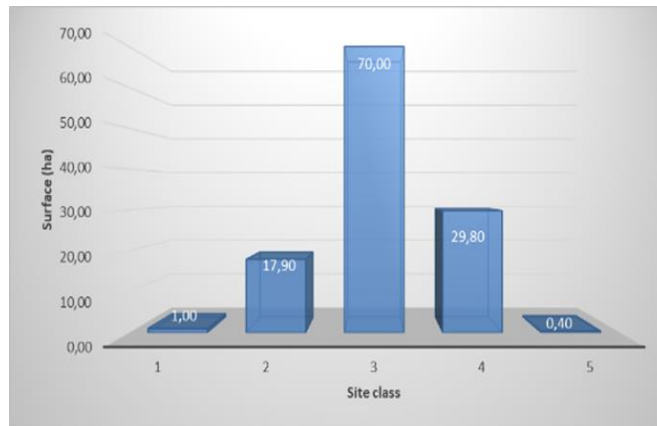


FIG. 8. Production class of Goat willow stands.

## CONCLUSION

The total surface occupied by this species in this area is of 119,1 ha, with high percentages in Cislău, Slănic and Vintilă Vodă Forest Districts. The average altitude of these stands is of 550 m, with average slopes of 16g - 32g, and south and south-east expositions. The main soils are typical eutric cambisol, fluvisol and erodisol. The characteristics of these stands are the following: a 9112 forest type (mixed common beech stand from the hill area), small ages (1-70 years), and an average production class. Goat willow is the second willow species with a high economic-apicultural value. Furthermore, it plays an essential role in maintaining species diversity, being the host of numerous moss species.

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