



Maciej Filipiak, Anna Dolatowska, Marek Kmiecik, Zenon Pilarek

European ash in the Bardzkie Mountains – species characterization based on forest documentation

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Abstract: On the basis of forest taxation data the presence of European ash in the Bardzkie Mountains area (central part of the Sudety Mountains) was analysed. This included the reckoning of the number of sites and the area covered by ash in various forest habitat types, age classes, altitude zones and on variously slanted and exposed mountain sides. The decline in the number of ashes in younger age classes and complete absence of trees older than 140 years have been noted. In the Bardzkie Mountains ash is the main species forming the forest on mountain riparian forest stands (a 43% participation in the area of forest of this type). Considering the number of specimens most ashes are scattered in mountain broadleaved forest. To the altitude of 650 m ash' participation in the forest stand composition is stable (30% of analysed locations), but it occupies only 2.6% of total forest area.

Additional key words: ecology, *Fraxinus excelsior*, Sudety Mountains.

Addresses: M. Filipiak, Polish Academy of Sciences, Institute of Dendrology, Parkowa 5, 62-035 Kórnik, Poland, e-mail: mfil@rose.man.poznan.pl
A. Dolatowska, Polish Academy of Sciences, Institute of Dendrology, Parkowa 5, 62-035 Kórnik, Poland, e-mail: aniadola@poczta.onet.pl
M. Kmiecik, Bardo Śląskie Forest District, Noworudzka 9a, 57-256 Bardo Śląskie, Poland, e-mail: oksana@pulsar.net.pl
Z. Pilarek, Forest Faculty, Agricultural University in Poznań, Wojska Polskiego 28, 61-662 Poznań, Poland, e-mail: zpilarek@owl.au.poznan.pl

Introduction

The Bardzkie Mountains are a small range in the central part of the Polish Sudety Mountains. Not many works on the chorology of trees and shrubs in the Bardzkie Mountains have been published although it is a very interesting area owing to its location: the whole of it is situated in Poland and the majority of it lies within one forest district (Bardo). In the past the whole area was part of Germany. It can, therefore, be assumed that its individual parts (both nowadays and in the past) were subject to similar eco-

nomic activity. Data from slopes of various exposures are of equal availability and collected in the same manner. The diversified relief of the land, which is related to the diversified geological structure, as well as the former ownership structure, with a vast participation of peasants' forests, resulted in the forests being less exploited and utilised than in the other parts of the Sudety Mountains, e.g. Karkonosze, Izerskie Mountains and the neighbouring Sowie Mountains (Martynowski and Mazurski 1988, Walczak 1968). Lower participation of spruce monocultures and higher participation of deciduous forests which cover

fertile sites are characteristic of the area. There have also remained some of endangered species, such as yew and fir. It may be thus assumed that the forests are more natural than the other forest areas of the Sudety Mountains.

The European ash is highly valued by foresters and considered to be one of the forest-forming species (Ilmurzyński 1969). Its participation in the forest stands is, however, far lower than that of the oak or beech and the spruce and pine in particular. There have also been far less publications on it. A broad ecological characterization and a review of concerning literature have been presented by Faliński and Pawlaczyk (1995) who include the ash among postpioneers, i.e. trees holding an intermediate position between pioneers and species considered the ultimate forest constituents (e.g. beech, fir and yew). This group contains numerous species of diversified features. The broad ecological scale of ash is attested by e.g. its inclusion into the lowland-mountain species (Boratyński 1991). Although it is usually associated with moist habitats it grows very well also on less moist sites and therefore some foresters distinguish two forms of ashes, i.e. ashes growing on moist soil and on fresh one (Ilmurzyński 1969).

Forest taxation data, which are established mainly for management of forests, are rarely used for botanical purposes. They are, however, very interesting as collected in accordance with a specific manner and by people educated in natural sciences; therefore, they deserve to be applied in a broader way as they can supplement typical floristic observations.

Materials and methods

Using Kondracki's (1998) division the authors defined on the management maps of the Bardo and Jugów forest districts these forest areas and divisions

which are located in the Bardzkie Mountains area. On the basis of stand descriptions the subdivisions with the ash as a component were chosen. The area covered by ash in each such a unit was calculated by multiplying the subdivision area by the percentage participation of this tree in the forest stand. When the participation was described by the words: "in places" and "individual specimens", the subdivision area was multiplied by 0.05 (5%). In the further study, the ash subdivision is understood as the smallest forest unit marked on forest maps, which differs from the neighbouring plots in stand age, composition, density, trees volume, spatial structure or some other factors, and in which the tree was present. Furthermore, the individual stands (subdivisions) were sorted within various categories, such as age classes, exposure, habitat types of forest etc. In the same way all the subdivisions in the analysed area were sorted. For each category the number of subdivisions with the ash and the areas covered by this tree were compared with general numbers and areas of subdivisions. The χ^2 test was used to test the distribution differences (Krzysztofak and Urbanek 1981).

Results

The presence of the ash was analysed on a forest area of 7756 ha in which 2294 subdivisions were identified. The ash is present in 703 subdivisions, i.e. 30.65% of their total, and covers the area of 204.9 ha, i.e. only 2.6% of the total. The average area covered by ash on one location is 0.29 ha.

The data concerning the age structure (Fig. 1) draw attention to the very low participation of the ash in the older age classes, particularly in classes VII and VIII, and its complete absence in classes older than VIII, though it is a long-lived tree. This is probably related to the strict abundance by the ash felling age at

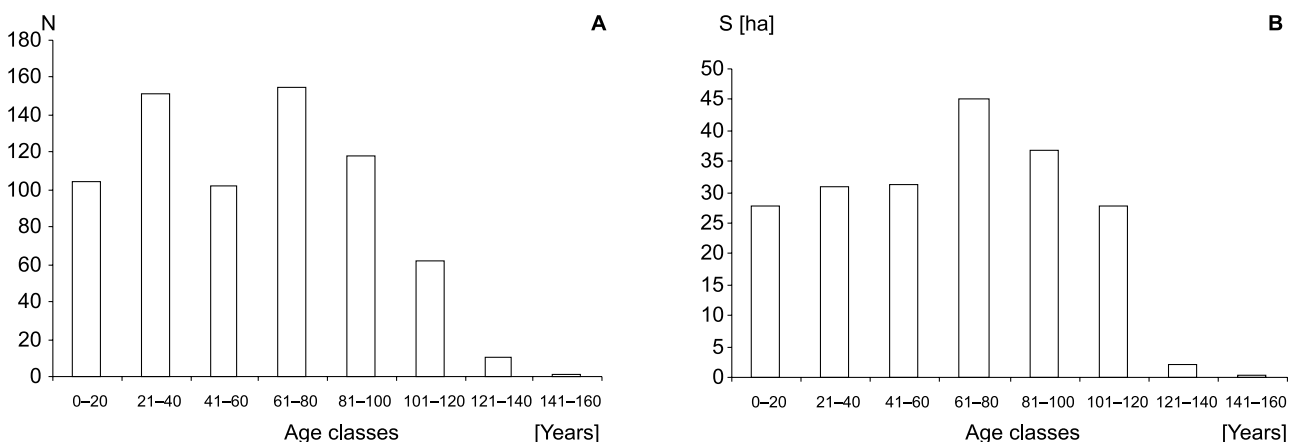


Fig. 1. A. Number (N) of ash subdivisions in the Bardzkie Mountains by age classes; B. Area (S) covered by the ash in the Bardzkie Mountains by age classes

I class – age 0–20 years; II class – age 21–40 years; III class – age 41–60 years; IV class – age 61–80 years; V class – age 81–100 years; VI class – age 101–120 years; VII class – age 121–140 years; VIII class – age 141–160 years

120 years. More worrying is, however, the lower participation of the ash in younger age classes. This especially refers to the area covered by the tree (Fig. 1 B). The analysed species is not assumed to be endangered, moreover, it is considered expansive (Boratyński 1991, Kosiński 2001), but our data suggest that its participation in the forest composition of the analysed area is declining. It is, nevertheless, possible that with age the ash increases its participation in the forest stand at the cost of other species. This issue should be analysed in greater detail.

The number of subdivisions and the area covered by the ash clearly drop in relation to the increasing altitude above sea level (Figs 2 A, 2 B). This, however, results mainly from the fact that the total forest area declines relatively to the increasing altitude (Fig. 2 C). The number of forest stands (subdivisions) in which the ash is present in relation to the total number of subdivisions at a given altitude (Fig. 2 D) is practically constant in the analysed altitude range (i.e. 300–650 m above sea level) and is approximately 30%. This is rather surprising if we consider the maximum altitude at which the ash was noted in East Sudety (870 m) and in West Sudety Mountains (880 m). Moreover the ash grows there only as single specimens. It should also be stressed that the forest areas in the Bardzkie Mountains located above 550 m are usually sub-peak areas which tend to be dryer (due to shallower soil and stronger atmospheric impact, particularly wind). It should be noted that the participation of the ash in the forest area above 600 m drops by approximately 20% in relation to the area located at lower altitudes (Fig. 2 E).

The authors noticed (Fig. 3) that the ash slightly prefers mountain slopes of eastern and in particular north-eastern exposures, i.e. located by the side of the lowlands from where the ash could have entered the mountain areas, whereas avoids southern exposures. The data presented on figures 3 B and 3 C show that influence of exposures mentioned above on the presence of ash is statistically significant (χ^2 test). Similar results were obtained by Boratyński (1991) in West Sudety Mountains, while Kosiński (2001) indicates the preference of north-western exposures in East Sudety Mountains.

The data presented in figure 4 show that the largest number of ashes, both in relation to the number of locations and to the covered area, is present on steep (21–30°) and sloping (11–20°) mountainsides, however, the largest participation in the forest stand composition is observed in sites located in valleys (Fig. 4 D). It seems that the angle of sloping itself does not play any significant role, but the type of habitat which has been established in specific conditions is important.

The data presented in figure 5 prove that in the conditions of the Bardzkie Mountains the ash is most

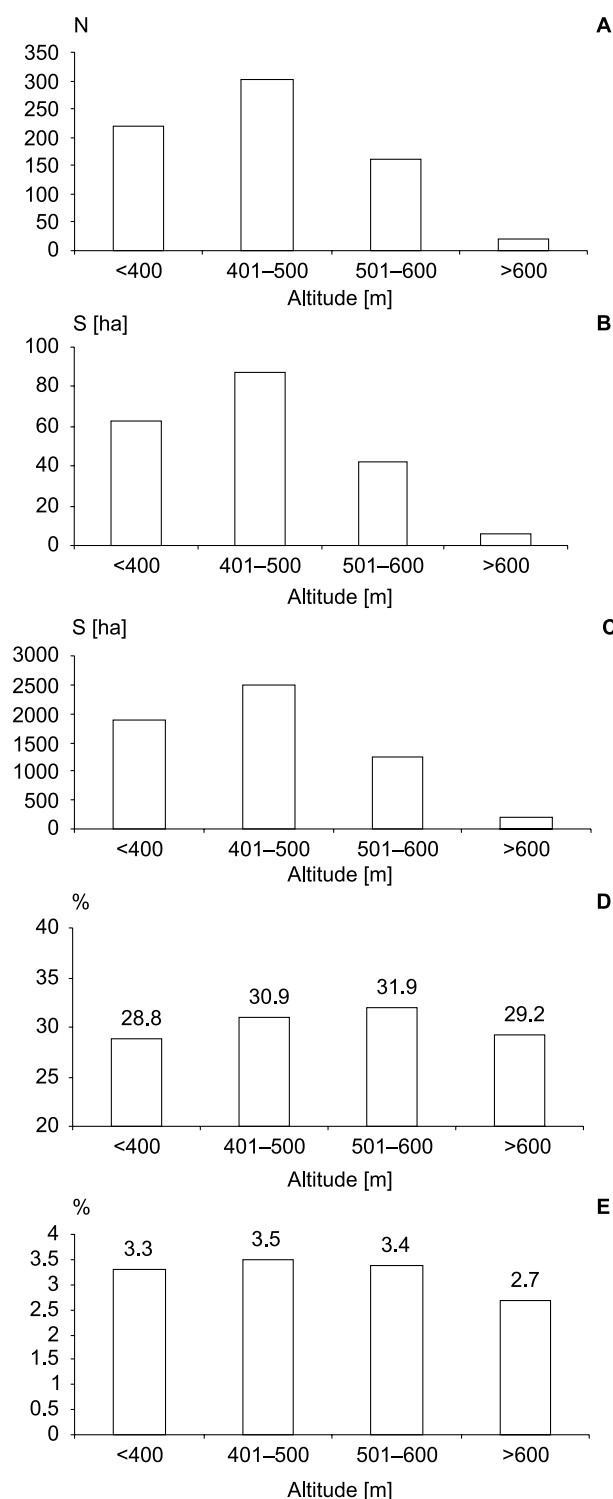


Fig. 2. A. Number (N) of ash subdivisions in the Bardzkie Mountains in 100-metre altitudinal belts; B. Area (S) covered by the ash in the Bardzkie Mountains in 100-metre altitudinal belts; C. Total area (S) of forest stand in the Bardzkie Mountains in 100-metre altitudinal belts; D. Participation of forest stands with the ash in the total number of forest stands (subdivisions) in 100-metre altitudinal belts; E. Participation of the area covered by the ash in the Bardzkie Mountains in the total area of forest stands (subdivisions) in 100-metre altitudinal belts

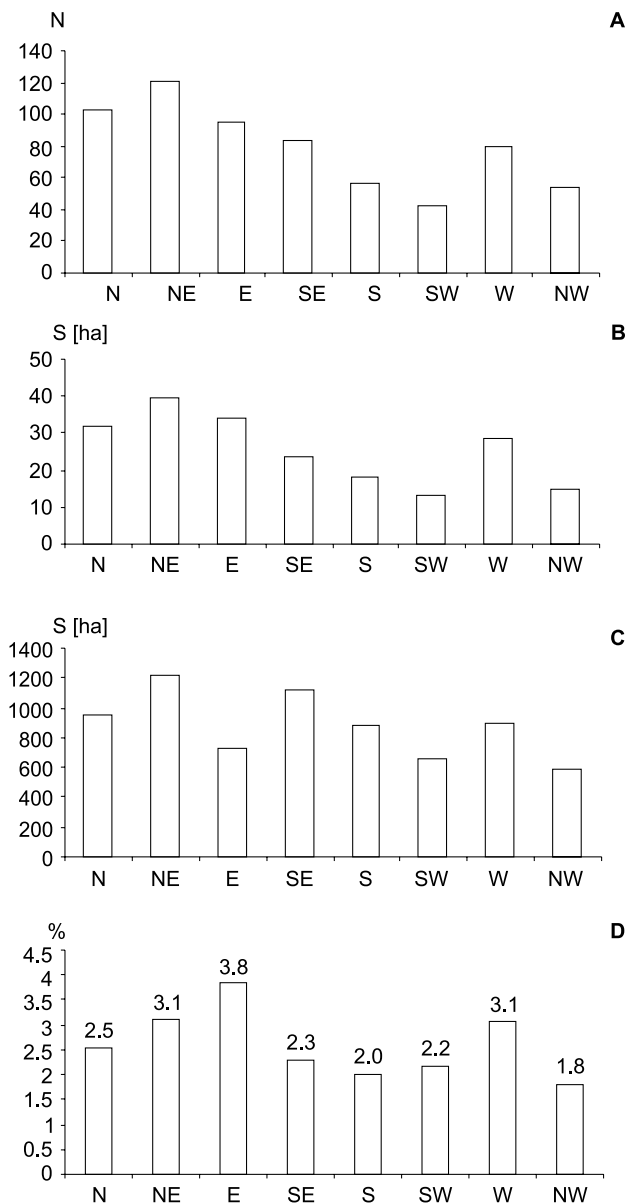


Fig. 3. A. Number (N) of ash subdivisions in the Bardzkie Mountains by forest stands growing on mountainsides of specific exposures; B. Area (S) covered by the ash in the Bardzkie Mountains by forest stands growing on mountainsides of specific exposures; C. Total area (S) of forest stand in the Bardzkie Mountains growing on mountainsides of specific exposures; D. Participation of the area covered by the ash in the Bardzkie Mountains in the total area of forest stands (subdivisions) growing on mountainsides of specific exposures

common in mountain riparian forest (forest site type MRF) which can almost exclusively be observed in river and stream valleys. These habitats, however, cover only 8% of the total forest area. Most ashes from the analysed area are present in mountain broadleaved forest (MBF). It should be noted that the participation of the ash in forest site types related to oak hornbeam forest (upland mixed broadleaved forest UMBF and upland broadleaved forest UBF), is sig-

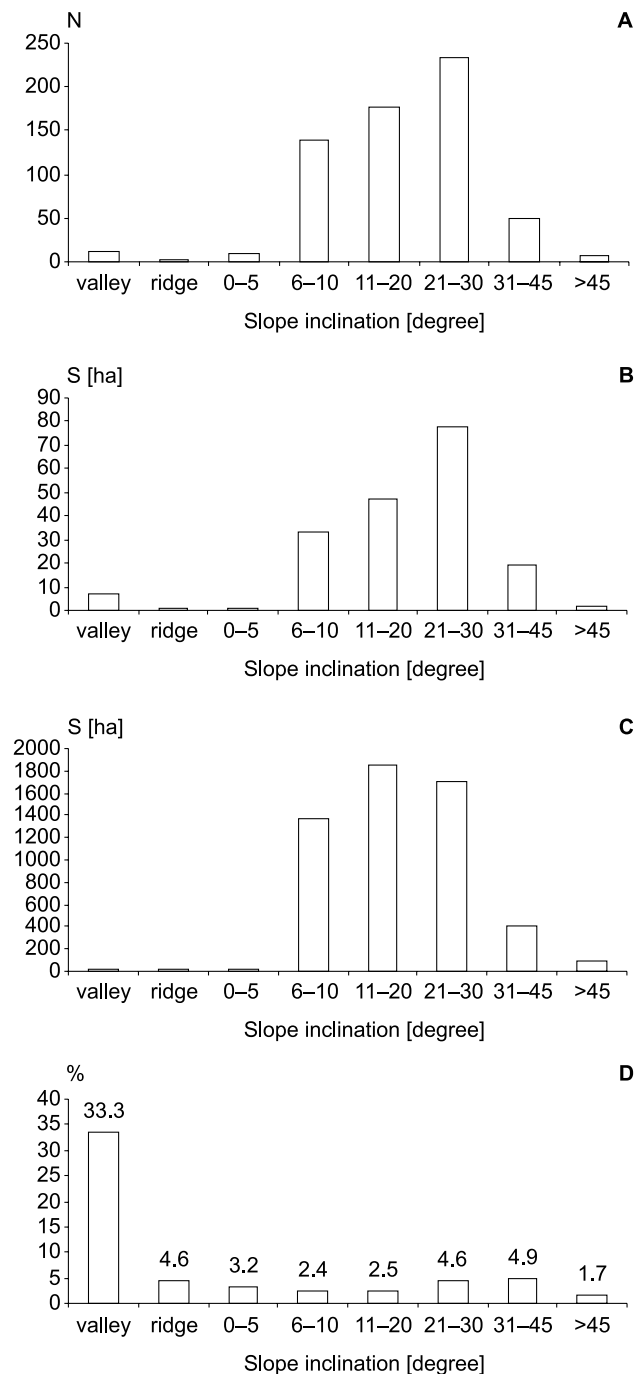


Fig. 4. A. Number (N) of ash subdivisions in the Bardzkie Mountains by forest stands growing on mountainsides of defined inclination; B. Area (S) covered by the ash in the Bardzkie Mountains by forest stands growing on mountainsides of defined inclination; C. Total area (S) of forest stand in the Bardzkie Mountains growing on mountainsides of defined inclination; D. Participation of the area covered by the ash in the Bardzkie Mountains in the total area of forest stands (subdivisions) growing on mountainsides of defined sloping angle

nificantly lower than in site types related to beech forests (mountain broadleaved forest MBF and mixed mountain broadleaved forest MMBF). The results concerning the habitats confirm the opinion about

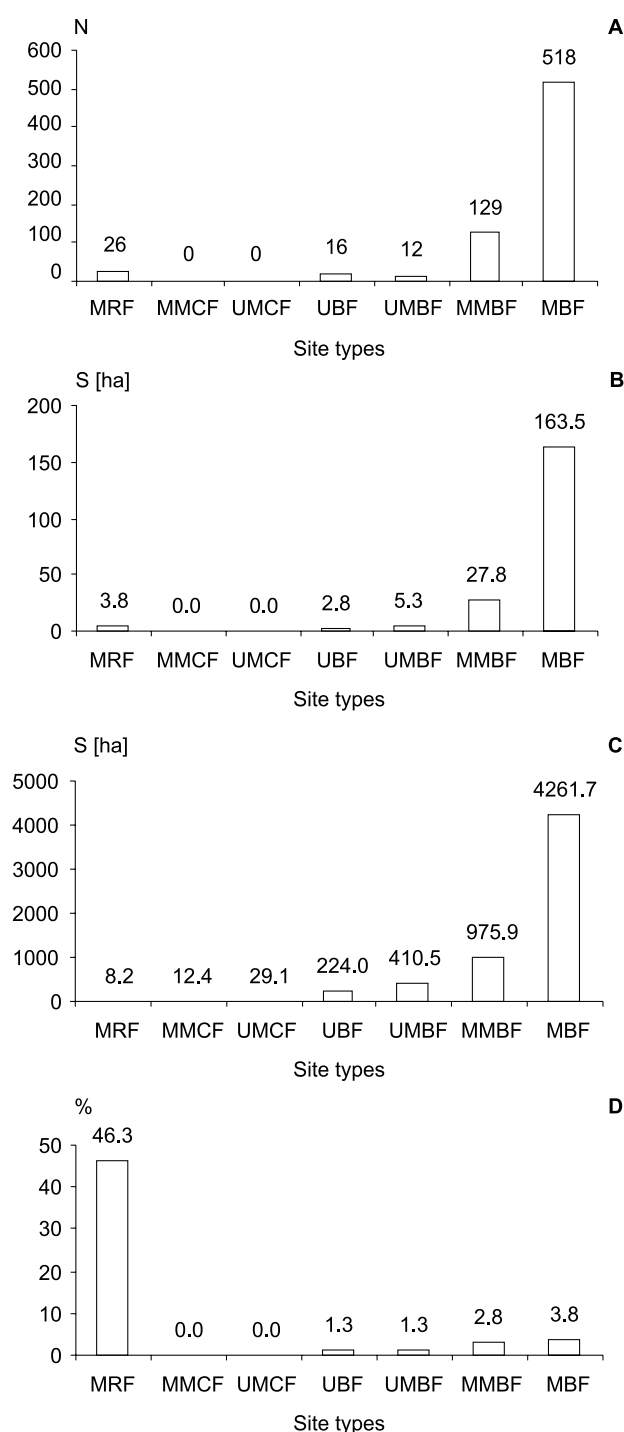


Fig. 5. A. Number (N) of ash subdivisions in the Bardzkie Mountains by specific forest site type; B. Area (S) covered by the ash in the Bardzkie Mountains by specific forest site type; C. Total area (S) of forest stand in the Bardzkie Mountains by specific forest site type; D. Participation of the area covered by the ash in the Bardzkie Mountains in the total area of forest stands (subdivisions) by specific forest site type

MRF – mountain riparian forest; MMCF – mountain mixed coniferous forest, UMCF – upland mixed coniferous forest, UBF – upland broadleaved forest, UMBF – upland mixed broadleaved forest; MMBF – mountain mixed broadleaved forest, MBF – mountain broadleaved forest

the high requirements of the ash in relation to soil fertility, that is a large participation in fertile mountain riparian forest and mountain broadleaved forest habitats (e.g. Faliński and Pawlaczyk 1995, Ilmurzyński 1969). There are no ashes in “coniferous” forest habitats (mountain mixed coniferous forest MMCF and upland mixed coniferous forest UMCF).

Conclusions

In the Bardzkie Mountains the European ash is a common species at least to the altitude of 650 m, particularly in the mountain broadleaved forest. But its participation in the forest stand composition is low: on average 2.6% of total forest area. This is true for most of the forest types with the exception of the mountain riparian forest habitat in which the ash is the main species forming the forest stand.

A decline in the number of ashes in younger age classes has been noted.

In the Bardzkie Mountains the analysed species does not show a strong preference to mountainsides of specific inclinations. It slightly prefers mountain slopes of eastern and north-eastern exposures and is more common in habitats which are potentially related to beech forests than to oak hornbeam forests.

The data from the forest valuation may provide interesting information about the ecology of the main forest species and should be applied in a broader manner.

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