

REGIONS OF PROVENANCES OF *Fraxinus angustifolia* Vahl. AND *Fraxinus pallisae* Wilmott IN SERBIA

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Abstract: The production of selected and reproductive material of known origin makes it necessary to designate the regions of provenance of our most significant forest tree species. The regions of provenance are defined as one or more areas with similar ecological characteristics, in which the stands of a species, subspecies or variety have similar phenotype or genotype characteristics. Two regions of provenance of closely related species, narrow-leaved ash (*Fraxinus angustifolia* Vahl.) and Balkan ash (*Fraxinus pallisae* Wilmott) were designated in Serbia based on the analysis of their actual distribution and on the study of ecological vegetation characteristics of their populations.

Keywords: narrow-leaved ash, Balkan ash, region of provenance, ecological-vegetation characteristics, *Fraxinus angustifolia*, *Fraxinus pallisae*.

РЕГИОНИ ПРОВЕНИЈЕНЦИЈА *Fraxinus angustifolia* Vahl.
И *Fraxinus pallisae* Wilmott У СРБИЈИ

Извод: Производња селекционисаног и репродуктивног материјала познатог порекла намеће потребу дефинисања региона провенијенција наших најзначајнијих врста шумског дрвећа. Региони провенијенције се дефинишу као једна или више области са сличним еколошким карактеристикама, у којима састојине врсте, подврсте или варијетета имају сличне фенотипске или генотипске карактеристике. Два региона провенијенције веома сродних врста - пољског јасена (*Fraxinus angustifolia* Vahl.) и маљавог пољског јасена (*Fraxinus pallisae* Wilmott) су дефинисана у Србији на основу њиховог стварног распрострањења и проучавања еколошко-вегетацијских карактеристика њихових популација

Кључне речи: пољски јасен, маљави пољски јасен, регион провенијенција, еколошко-вегетацијске карактеристике, *Fraxinus angustifolia*, *Fraxinus pallisae*.

1. INTRODUCTION

Modern plant production must be based on good-quality seed and planting material of known origin and, for this reason, the organisation of production of forest reproductive material must be based on scientific foundations, with the

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legal regulation of the matter.

Since the early 1990s, Europe has been developing a policy network that supports the concept that “local is the best”, at least in the context of planting for non-production objectives. Regarding seed sources, European forest policy has a strong focus on local planting material, and defining more varied roles of forests. According to the Helsinki Guidelines developed by the Second Ministerial Conference on the Protection of Forests in Europe (MCPFE 1993), “native species and local provenances should be preferred where appropriate”. The “appropriate” context for local material is in planting primarily for conservation and environmental objectives, and this criterion does not necessarily need to be applied in plantations for timber, where the best selected material may not be local (FRAXIGEN 2005). For common ash and narrow-leaved ash, genetic improvement programs remain important at both national and regional levels to identify superior reproductive material for production planting within a plantation environment. At the same time, there is a growing interest in seed sourcing for enrichment planting and ecological restoration. The principles of the Helsinki Guidelines have been repeated in the resolutions adopted by the subsequent MCPFE conferences in Lisbon (1998) and Vienna (2003).

The EC Council Directive 1999/105/EC on the marketing of Forest Reproductive Material (FRM) expanded the list of species subject to regulation to 46, which includes *Fraxinus angustifolia* Vahl. The directive is interpreted through legislation in each member state, controlling the marketing of FRM of these species. Serbia also has harmonized its legislation on FRM with this directive. In Serbia, regions of provenances are defined for several species, using different methodologies. For example, regions of provenances were defined based on: variability of chloroplast DNA of sessile oak (Šijačić-Nikolić, M. *et al.* 2009), genetic variability of Austrian pine (Lučić, A. *et al.* 2010), genetic-ecological variation of Scots pine (Lučić, A. *et al.*, 2011), and spatial distribution of population of beech (Ivetić, V. *et al.*, 2012).

The Law on Forest Reproductive Material (“Official Gazette of the Republic of Serbia“, No. 135/2004, 8/2005) defines the four categories of reproductive material:

1. **Source identified** reproductive material derived from trees or stands, of which the altitude and the region of provenance are known;
2. **Selected** reproductive material produced in seed stands;
3. **Qualified** reproductive material derived from parent trees, clones, clonal mixtures or from seed orchards, phenotypically selected at individual level;
4. **Tested** reproductive material produced in seed stands and seed orchards, derived from parent trees, clones or clonal mixtures whose superior quality must be recognised by comparative tests, compliant with the regulations on the release of forest plant varieties, or evaluated based on the genetic quality of the parts of basic material.

Only the selected, qualified or tested reproductive materials may be used for forest establishment and regeneration. Source identified reproductive material can be used only within the same region of provenance, if there is not a sufficient supply of the selected, qualified or tested seeds, or if the volume of afforestation has to be additionally increased because of force majeure (forest fire, natural

disasters, etc.).

The production of the selected material and source identified reproductive material makes it necessary to designate the regions of provenance of our most significant forest tree species. The regions of provenance are defined as one or more areas with similar ecological characteristics, in which the stands of a species, subspecies or variety have similar phenotype or genotype characteristics.

The genus *Fraxinus* (Fam. Oleaceae) includes 65 species, mostly in temperate regions, less often in subtropical and tropical zones. In Serbia there are 4 native species in this genus: flowering ash (*F. ornus* L.), white ash (*F. excelsior* L.), narrow-leaved ash (*F. angustifolia* Vahl.), and Balkan ash (*F. pallisae* Willmott) (Jovanović, B., 1973). The last two species are closely related, and many authorities consider them to be conspecific (e.g. FRAXIGEN 2005). In this paper, regions of provenances of two closely related species, narrow-leaved ash and Balkan ash were designed based on the analysis of their actual distribution and on the study of ecological vegetation characteristics of their populations. Based on our research, it was possible to designate homogeneous units - regions distinguished by similar climate, soil and vegetation characteristics of the site, as well as by phenotype and genotype similarities of the analysed populations.

Narrow-leaved ash (*Fraxinus angustifolia* Vahl.) morphology and distribution in former Yugoslavia was studied by Fuka rek, P. (1954, 1960, 1983), and in Serbia by Jovanović, B. (1951, 1973, 1986). Plant communities of narrow-leaved ash were studied by Tomić, Z. *et al.* (2001), its forest types in Ravni Srem by Jović, D. *et al.* (1994), and its silvicultural needs in different forest types in Srem by Bobinac, M. (1988). *Fraxinus palliseae* Willmott morphology and distribution was studied by Jovanović, B. (1973).

Speaking about native narrow-leaved ashes, *Fraxinus angustifolia* Vahl. is distributed along the coasts of the Mediterranean Sea and the Black Sea, the Atlantic in Portugal, in western France, and in the region of Pannonia, while *Fraxinus pallisae* Willmott grows in southern Ukraine, Moldavia, Romania, Bulgaria, Macedonia and north eastern Serbia (Jovanović, B., 2007). On the Balkan Peninsula, *Fraxinus angustifolia* Vahl. ranges along the sea coast and in the river valleys in Albania, Greece, Romania and Bulgaria. In Serbia, *Fraxinus angustifolia* Vahl. is distributed in the region of Pannonia and in river valleys, where it has probably been preserved thanks to the effect of water bodies (Jovanović, B., 1991). The only recorded native site of *Fraxinus pallisae* Willmott is in the extreme eastern Serbia, around Negotin - former Negotinsko blato (Jovanović, B., 1957, 2007). This extreme eastern part of Serbia - Krajina, possesses climatic peculiarities, compared to other parts of Serbia, caused by its remoteness from the sea and openness to the Wallachian lowland, so this area is one of the driest in former Yugoslavia, and possesses the most pronounced continental climate in Serbia (Jovanović, B., 1997).

2. MATERIAL AND METHODS

With the aim of determining the actual distribution of narrow-leaved ashes in Serbia, as the base for the designation of the regions of provenance of these

species, we started from the data of the National Forest Inventory of the Republic of Serbia, which were collected within the framework of the Project of the same name, realised by the Faculty of Forestry, University of Belgrade. The collected data refer to clusters – reference points in which narrow-leaved ash was recorded.

The clusters, i.e. sets of sample plots, were surveyed in order to assess the state of the growing stock and to evaluate the tendencies of its development. Cluster network was designed in the grid of 4 x 4 km; the distance between cluster centres (reference points) was 4 km. By the applied methodology, each cluster consists of four sample plots. The centre of the first sample plot at the point of the intersection of the cluster network, i.e. in the reference points, and the other three sample plots are distributed on the vertexes of the square, the side of which is 200 m. The centres of clusters and sample plots are determined by the coordinates, and the reference points (centres of clusters) are located in the field by the application of the GPS unit (National Forest Inventory of the Republic of Serbia – Technical Manual).

Each reference point (cluster) has an organised data base consisting of: coordinates, general cluster and sample plot indications (district, municipality, management unit, compartment and subcompartment, site description (soil type, altitude, slope, aspect, ownership, soil risk, dead cover and humification process) and stand description (tree species, age, stand classification, stand origin and structure, stand development stage, mixture, canopy closure, main characteristics of regeneration, naturalness, and the possibility of site treatment).

3. RESULTS AND DISCUSSION

Distribution of *Fraxinus angustifolia* Vahl. and *Fraxinus pallisae* Wilmott is, based on the data of the National Forest Inventory of the Republic of Serbia, presented in Table 1.

Table 1. Survey of clusters in which narrow-leaved ash was recorded, based on National Forest Inventory of the Republic of Serbia

Табела 1. Преглед кластера у којима је забележен пољски јасен, на основу резултата Националне инвентуре шума у Републици Србији

Clust. Num.	X-coord.	Y-coord.	Municipality	Altitude	Ownership	Origin	Mixed
02 SREDNJE-BANATSKI DISTRICT							
919	5002200	7444000	Zrenjanin	75	state	nat.copp.stand	mix.broad.st.
05 ZAPADNO-BAČKI DISTRICT							
444	5054000	7352200	Apatin	76	state	nat.gen.stand	clean broad.st.
519	5046200	7348000	Apatin	84	state	artif.stand	clean broad.st.
449	5050000	7340200	Apatin	85	state	artif.stand	clean broad.st.
231	5078200	7336000	Sombor	88	unknown	artif.stand	clean broad.st.
231	5078200	7336200	Sombor	88	unknown	nat.copp.stand	clean broad.st.
520	5046000	7340200	Apatin	90	state	artif.stand	clean broad.st.

303	5066200	7340200	Apatin	90	state	nat.gen.stand	clean broad.st.
303	5066200	7340000	Apatin	90	state	nat.copp.stand	mix.broad.st.
232	5074200	7336000	Sombor	94	unknown	nat.copp.stand	clean broad.st.
06 JUŽNO-BAČKI DISTRICT							
741	5022000	7352000	Bač	86	state	nat.gen.stand	mix.broad.st.
741	5022000	7352200	Bač	86	state	nat.gen.stand	clean broad.st.
658	5030200	7364000	Bač	88	private	nat.gen.stand	mix.broad.st.
664	5026200	7344000	Bač	91	state	nat.copp.stand	mix.broad.st.
741	5022200	7352000	Bač	95	state	nat.gen.stand	clean broad.st.
07 SREMSKI DISTRICT							
1452	4954200	7420000	Pećinci	73	private	nat.copp.stand	mix.broad.st.
1086	4986200	7356000	Šid	80	state	nat.gen.stand	mix.broad.st.
1176	4978200	7352000	Šid	80	private	nat.gen.stand	clean broad.st.
1176	4978000	7352000	Šid	80	private	nat.gen.stand	clean broad.st.
1175	4982000	7356200	Šid	80	state	nat.gen.stand	mix.broad.st.
1175	4982200	7356200	Šid	80	private	nat.gen.stand	clean broad.st.
1175	4982200	7356000	Šid	80	private	nat.gen.stand	clean broad.st.
1086	4986000	7356000	Šid	80	state	nat.gen.stand	clean broad.st.
1175	4982000	7356000	Šid	80	state	nat.gen.stand	mix.broad.st.
1174	4982200	7360200	Šid	80	private	nat.gen.stand	mix.broad.st.
1174	4982200	7360000	Šid	80	private	nat.gen.stand	mix.broad.st.
1174	4982000	7360000	Šid	80	private	nat.gen.stand	clean broad.st.
1176	4978200	7352200	Šid	80	private	nat.gen.stand	mix.broad.st.
1086	4986200	7356200	Šid	80	state	nat.gen.stand	clean broad.st.
1085	4986000	7352200	Šid	80	state	nat.gen.stand	mix.broad.st.
1085	4986200	7352200	Šid	80	state	nat.gen.stand	clean broad.st.
1085	4986200	7352000	Šid	80	state	nat.gen.stand	clean broad.st.
1085	4986000	7352000	Šid	80	state	nat.gen.stand	mix.broad.st.
1084	4990200	7352200	Šid	80	state	nat.gen.stand	mix.broad.st.
1086	4986000	7356200	Šid	80	state	nat.gen.stand	mix.broad.st.
1177	4978000	7356000	Šid	80	private	nat.gen.stand	clean broad.st.
1174	4982000	7360200	Šid	80	private	nat.gen.stand	mix.broad.st.
1178	4978000	7360200	Sr. Mitrovica	80	state	nat.gen.stand	mix.broad.st.
1177	4978000	7356200	Šid	80	private	nat.gen.stand	mix.broad.st.
1177	4978200	7356200	Šid	80	private	nat.gen.stand	mix.broad.st.
1177	4978200	7356000	Šid	80	private	nat.gen.stand	mix.broad.st.
1178	4978200	7360200	Sr. Mitrovica	80	private	nat.gen.stand	clean broad.st.
1450	4954000	7412000	Ruma	82	state	nat.copp.stand	clean broad.st.
1450	4954200	7412000	Ruma	82	state	nat.gen.stand	clean broad.st.
1450	4954200	7412200	Ruma	83	state	nat.copp.stand	mix.broad.st.
1450	4954000	7412200	Ruma	83	state	nat.copp.stand	clean broad.st.
1426	4958000	7416000	Pećinci	83	private	nat.copp.stand	clean broad.st.

1268	4974000	7352000	Šid	85	private	nat.gen.stand	mix.broad.st.
1268	4974200	7352000	Šid	85	private	nat.gen.stand	mix.broad.st.
1268	4974200	7352200	Šid	85	private	nat.gen.stand	mix.broad.st.
1268	4974000	7352200	Šid	85	private	nat.gen.stand	clean broad.st.
1453	4954000	7424000	Pećinci	90	state	nat.copp.stand	clean broad.st.
1453	4954200	7424200	Pećinci	91	state	nat.gen.stand	mix.broad.st.
1453	4954200	7424000	Pećinci	91	state	nat.copp.stand	clean broad.st.
1547	4946200	7416200	Pećinci	92	state	nat.copp.stand	clean broad.st.
1453	4954000	7424200	Pećinci	92	state	nat.copp.stand	clean broad.st.
1547	4946000	7416000	Pećinci	94	state	nat.copp.stand	clean broad.st.
1547	4946200	7416000	Pećinci	94	state	nat.copp.stand	clean broad.st.
08 MAČVANSKI DISTRICT							
1353	4962200	7368000	Bogatić	0	private	nat.copp.stand	clean broad.st.
1262	4974200	7392200	Bogatić	70	private	nat.gen.stand	clean broad.st.
1260	4974000	7400000	Šabac	77	private	nat.copp.stand	clean broad.st.
1260	4974000	7400200	Šabac	78	private	nat.gen.stand	mix.broad.st.
1263	4974000	7388200	Bogatić	80	private	nat.copp.stand	clean broad.st.
263	4974200	7388200	Bogatić	80	private	nat.copp.stand	clean broad.st.
1263	4974000	7388000	Bogatić	81	private	nat.copp.stand	mix.broad.st.
1524	4950000	7404000	Šabac	82	private	nat.copp.stand	clean broad.st.
1531	4950200	7376200	Šabac	82	unknown	nat.copp.stand	mix.broad.st.
1522	4950200	7412200	Vladimirci	83	private	nat.copp.stand	mix.broad.st.
1274	4970000	7384000	Bogatić	85	private	nat.copp.stand	clean broad.st.
1348	4966200	7388200	Bogatić	90	private	nat.copp.stand	mix.broad.st.
1520	4950000	7420200	Vladimirci	91	private	nat.copp.stand	clean broad.st.
1264	4974200	7384200	Bogatić	93	private	nat.copp.stand	mix.broad.st.
1346	4966000	7396200	Šabac	96	private	nat.copp.stand	clean broad.st.
1655	4938000	7364200	Loznica	106	state	nat.gen.stand	mix.broad.st.
1665	4938000	7404000	Vladimirci	113	private	nat.gen.stand	clean broad.st.
1443	4954200	7384000	Šabac	128	private	nat.gen.stand	clean broad.st.
1347	4966200	7392200	Šabac	765	private	nat.copp.stand	mix.broad.st.
09 KOLUBARSKI DISTRICT							
1902	4926200	7420000	Ub	0	private	nat.copp.stand	mix.broad.st.
1807	4930200	7432000	Ub	91	private	nat.gen.stand	mix.broad.st.
1807	4930200	7432200	Ub	101	private	nat.gen.stand	clean broad.st.
1804	4930000	7420000	Ub	133	private	nat.gen.stand	clean broad.st.
1938	4922000	7428000	Ub	166	private	nat.copp.stand	mix.broad.st.
2173	4910200	7416200	Valjevo	235	Private	nat.copp.stand	clean broad.st.
10 PODUNAVSKI DISTRICT							
1823	4930000	7496000	Sm. Palanka	0	Private	nat.gen.stand	mix.broad.st.
1686	4938000	7488000	Smederevo	75	Private	nat.copp.stand	clean broad.st.
2093	4914200	7508200	V. Plana	100	Private	nat.copp.stand	mix.broad.st.

1686	4938200	7488200	Smederevo	110	Private	nat.copp.stand	mix.broad.st.
2091	4914000	7500200	Sm. Palanka	170	Private	nat.copp.stand	clean broad.st.
11 BRANIČEVSKI DISTRICT							
1694	4938000	7520000	M. Crniće	79	Private	nat.gen.stand	mix.broad.st.
1694	4938200	7520200	M. Crniće	93	Private	nat.copp.stand	clean broad.st.
1694	4938200	7520000	M. Crniće	95	Private	nat.copp.stand	clean broad.st.
1569	4946200	7504000	Požarevac	100	State	nat.copp.stand	clean broad.st.
2143	4910000	7536200	Petrovac	142	Private	nat.copp.stand	mix.broad.st.
1874	4926000	7532000	Petrovac	166	Private	nat.copp.stand	mix.broad.st.
1877	4926200	7520000	Žabari	188	Private	nat.copp.stand	mix.broad.st.
12 ŠUMADIJSKI DISTRICT							
2365	4898200	7492200	Rača	168	Private	nat.copp.stand	clean broad.st.
2024	4918000	7464000	Arandelovac	204	Private	nat.copp.stand	clean broad.st.
2939	4862200	7480200	Knić	260	Private	nat.gen.stand	clean broad.st.
2997	4858000	7484000	Knić	260	Private	nat.copp.stand	mix.broad.st.
2566	4886000	7484200	Kragujevac	288	Private	nat.copp.stand	clean broad.st.
13 POMORAVSKI DISTRICT							
3130	4850000	7540200	Paraćin	243	Private	nat.gen.stand	mix.broad.st.
14 BORSKI DISTRICT							
2118	4914200	7608200	Negotin	284	Private	nat.copp.stand	clean broad.st.
17 MORAVIČKI DISTRICT							
3110	4850000	7460200	Čačak	230	Private	nat.copp.stand	mix.broad.st.
2944	4862000	7460000	Čačak	260	Private	nat.copp.stand	mix.broad.st.
3068	4854200	7452200	Čačak	275	Private	nat.copp.stand	clean broad.st.
2942	4862200	7468000	Čačak	320	State	nat.copp.stand	clean broad.st.
18 RAŠKI DISTRICT							
3185	4846200	7468000	Kraljevo	217	Private	nat.gen.stand	mix.broad.st.
3112	4850200	7468000	Kraljevo	220	Private	nat.gen.stand	mix.broad.st.
3111	4850000	7464200	Kraljevo	228	Private	nat.gen.stand	mix.broad.st.
3185	4846000	7468200	Kraljevo	240	Private	nat.copp.stand	clean broad.st.
30 BELGRADE CITY							
1518	4950000	7428000	Obrenovac	74	State	nat.copp.stand	mix.broad.st.
1515	4950000	7440000	Zemun	82	State	nat.gen.stand	clean broad.st.
1515	4950200	7440200	Zemun	82	State	nat.gen.stand	mix.broad.st.
1515	4950000	7440200	Zemun	82	State	nat.gen.stand	clean broad.st.
1515	4950200	7440000	Zemun	83	State	nat.gen.stand	clean broad.st.
1516	4950000	7436000	Zemun	85	State	nat.gen.stand	clean broad.st.
1634	4942000	7436000	Obrenovac	88	Private	nat.copp.stand	clean broad.st.
1516	4950200	7436200	Zemun	88	State	nat.gen.stand	mix.broad.st.
1516	4950000	7436200	Zemun	89	State	nat.gen.stand	clean broad.st.
1674	4938200	7440200	Obrenovac	89	Private	nat.gen.stand	mix.broad.st.

1334	4966200	7444000	Zemun	95	Unknown	nat.gen.stand	mix.broad.st.
1334	4966000	7444000	Zemun	96	Unknown	nat.gen.stand	mix.broad.st.
2030	4918200	7440000	Lazarevac	110	Private	nat.gen.stand	clean broad.st.
2086	4914000	7480200	Mladenovac	170	Private	nat.copp.stand	mix.broad.st.

The studied species were recorded in 14 districts, at the altitudes between 100 and 300 m. Almost all recorded sites are that of *Fraxinus angustifolia* Vahl.

In *Srednje-Banatski District*, narrow-leaved ash was recorded in one cluster in the municipality Zrenjanin, at the altitude of 75 m.

In *Zapadno-Bački District*, narrow-leaved ash was recorded in 9 clusters, in the municipalities Apatin and Sombor, at the altitudes up to 100 m.

In *Južno-Bački District*, it was recorded in the municipality Bač (5 clusters), at the altitudes up to 100 m.

In *Sremski District*, it was recorded in 43 clusters, in the municipalities Šid, Pećinci, Sremska Mitrovica and Ruma, at the altitudes between 70 and 100 m.

In *Mačvanski District*, it was recorded in the municipalities Šabac, Bogatić, Vladimirci and Loznica, in 19 clusters, at the altitudes from 70 to 765 m.

In *Kolubarski District*, it was recorded in the municipalities Ub and Valjevo at the altitudes from 100 to 235 m.

In *Podunavski District*, it was recorded in the municipalities Smederevo, Smederevska Palanka and Velika Plana at the altitudes from 75 to 170 m.

In *Braničevski District*, it occurred in a greater number of municipalities, at the altitudes between 80 and 190 m.

In *Šumadijski District*, narrow-leaved ash was recorded at the altitudes from 168 to 288 m. It occurred in the municipalities Knić, Rača, Aranđelovac and Kragujevac.

In *Pomoravski District* and *Borski District*, there was only one cluster with narrow-leaved ash, at the altitudes above 200 m.

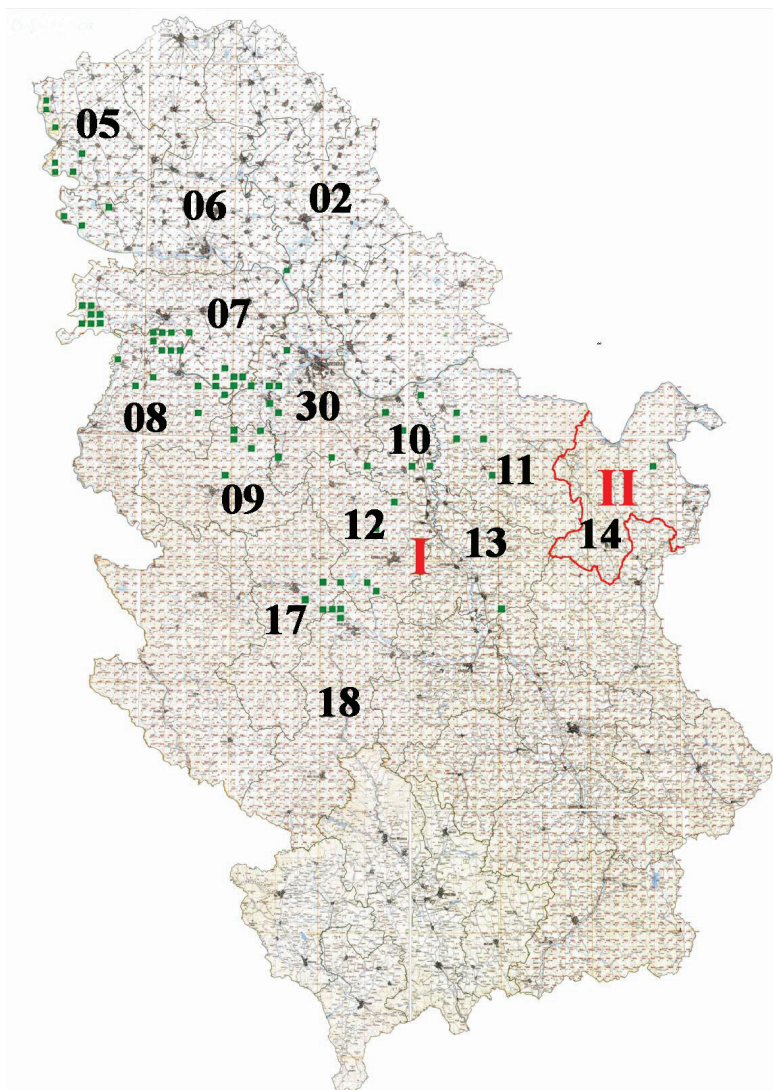
In *Moravički District*, it was recorded in the municipality Čačak, at the altitudes between 230 and 320 m.

In *Raški District*, it was recorded in the municipality Kraljevo, at the altitudes from 217 to 240 m.

In *Belgrade city* territory, it was recorded in the municipalities Obrenovac, Zemun, Lazarevac and Mladenovac, mainly at the altitudes up to 100 m, except in the municipalities Lazarevac and Mladenovac, where it grows at the altitudes 110, i.e. 170 m, respectively.

Borski District is specific, because it is the only region where, apart from *Fraxinus angustifolia*, *Fraxinus pallisae* was also recorded. That was the basis to set apart this district, as a separate region of provenance.

Therefore, two regions of provenance of narrow-leaved ashes were established in Serbia (Map 1).



Map 1. Regions of provenance of *Fraxinus angustifolia* Vahl. and *Fraxinus pallisae* Willmott in Serbia-green squares represent clusters with recorded studied species, and numbers correspond to District codes in Table 1

Карта 1. Региони провенијенција *Fraxinus angustifolia* Vahl. и *Fraxinus pallisae* Willmott у Србији-зелени квадрати представљају кластере са забележеним проучаваним врстама, а бројеви одговарају шифрама округа у Табели 1.

Region One consists of narrow-leaved ash forests (*Fraxinus angustifolia* Vahl.) in Podunavlje and Posavina in Vojvodina (Srednje-Banatski, Zapadno-Bački, Južno-Bački, Sremski, Mačvanski and Kolubarski Districts), and in Posavina, Pomoravlje and Podunavlje in Central Serbia (Podunavski, Braničevski, Šumadijski, Pomoravski, Moravički and Raški Districts, and the territory of

Belgrade city). Narrow-leaved ash in this region forms pure and mixed forests. Pure communities of narrow-leaved ash (*Carici remotae-Fraxinetum angustifoliae* Jovanović et Tomić 2004), and the forests of narrow-leaved ash with grey willow (*Saliceto cinereae-Fraxinetum angustifoliae* B. Jovanović 1979) are coenologically stable, but the ecological optimum of narrow-leaved ash is developed in mixed forests with common oak (*Fraxino angustifoliae-Quercetum roboris* B. Jovanović et Tomić 1979 and *Quercu roboris-Fraxinetum moesiacaе* Rudski 1949), at considerably more productive sites (Tomić, Z., 2004; Tomić, Z., Rakonjac, Lj., 2013). In the forest-steppe zone in Vojvodina (in the Danube Basin and Southeast Srem), in the considerably more contrasting climate conditions, narrow-leaved ash forms mixed forests with European white elm (*Fraxino-Ulmetum effusae* Slavnić 1952). In this area, the prevailing climate is continental (dry) steppe climate except in Šumadija region where the climate is humid (Kolić, B., 1988).

Region Two includes narrow-leaved ash forests in Borski District and East Serbia (Borski District), covering a relatively small geographic area. In this region, in addition to *Fraxinus angustifolia*, *Fraxinus pallisae* was also recorded and described, forming the community *Quercu roboris-Fraxinetum pallisae* B. Jovanović (1951)1982, with common oak in Negotinsko Blato. This area is characterised by highly contrasting continental climate (with very cold winters and warm summers) (Kolić, B., 1988).

4. CONCLUSIONS

Narrow-leaved ashes (*Fraxinus angustifolia* Vahl. and *Fraxinus pallisae* Willmott), were recorded in 14 Districts in Serbia, at the altitudes between 100 and 300 m, based on the data of the National Forest Inventory of the Republic of Serbia. They form pure and mixed forests (mainly with common oak), which are conditioned by additional moisture - flood or high levels of underground water.

In Serbia, two regions of provenance were designated based on the collected data on narrow-leaved ash species, distribution, plant communities and climate characteristics, as well as the need to define the optimal and operative regions of provenance.

This conclusion on two broad provenance regions for Serbia is in compliance with the general summary of FRAXIGEN research (FRAXIGEN 2005), conducted in narrow-leaved ash populations in several European countries (Bulgaria, Croatia, Greece, Hungary, Italy, Moldova, Romania, Slovakia, Slovenia, Spain and Turkey), on reproductive biology, genetic variation and local adaptation of the species. The main inference of this research has been:

“High levels of gene flow and broad adaptability suggest that the definition of a “local seed source” needs to be broad (up to 250 km scale), and that collection should stress increased distances between seed trees to ensure genetically diverse collections. Too narrow a vision of what is “local” (e.g. only one stand) is likely to result in the use of genetically less diverse material, with poorer adaptive potential”.

The Act on the designation of the region of provenance was passed by the Minister of Forestry. It contains the data on tree species, latitude and longitude, area, altitude, as well as other necessary data. Furthermore, a Map with clearly

defined boundaries of the regions of provenance for each species is a component part of the Act.

Within the designated regions of provenance, it is necessary to analyse the spatial pattern of the locations of the designated seed sources, their number and their actual state. In the cases of non-uniform distribution, insufficient number, or unsatisfactory state of seed forests within individual regions, it is necessary to designate the new ones, to cover the complete ecological, coenological and population diversity of the species.

In this manner, by abandoning the technology of forest seed and planting material production at the level of species, and accepting the level of the region of provenance, the representatives of which are the already designated seed sources, or the seed sources that are still to be designated, the production of forest reproductive material for the purposes of forest regeneration and forest establishment will be enhanced and intensified.

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РЕГИОНИ ПРОВЕНИЈЕНЦИЈА *Fraxinus angustifolia* Vahl.
И *Fraxinus pallisae* Wilmott У СРБИЈИ

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Резиме

Производња селекционисаног и репродуктивног материјала познатог порекла намеће потребу дефинисања региона провенијенција наших најзначајнијих врста шумског дрвећа, а једна од њих је пољски јасен (*Fraxinus angustifolia* Vahl.) и њему врло сродна врста маљави пољски јасен (*Fraxinus pallisae* Wilmott).

Пољски јасен је према подацима Националне инвентуре шума Републике Србије, евидентиран на територији 14 округа. Засновано на сагледавању стварног распрострањења пољског јасена и проучавању еколошко-вегетацијских карактеристика његових популација дефинисана су два региона провенијенције ове две врсте у Србији. Први регион чине шуме пољског јасена у Подунављу, Посавини, Поморављу, Шумадији и западној Србији. За овај регион карактеристично је присуство само пољског јасена (*Fraxinus angustifolia* Vahl.), који гради чисте и мешовите шуме (углавном са лужњаком) које су условљене допунским влажењем-поплавном или високим нивоом подземне воде. Други регион чине шуме пољског јасена у Борском округу и источној Србији, које су присутне на релативно малом географском подручју, на коме је поред пољског јасена (*Fraxinus angustifolia*) забележен и описан и маљави пољски јасен (*Fraxinus pallisae*), који у Неготинском блату, са лужњаком, гради заједницу *Quercus roboris-Fraxinetum pallisae* В. Јовановић (1951) 1982.

Унутар дефинисаних региона провенијенција потребно је сагледати просторни распоред локација на којима су издвојени семенски објекти, њихов број и тренутно стање. У случају неравномерног распореда у оквиру појединих региона, недовољног броја или незадовољавајућег стања семенских објеката потребно је извршити издвајање нових, како би у потпуности била обухваћена еколошка, ценолошка и популациона разноврсност пољског јасена.