COBISS 1.01

DISTRIBUTION OF THE ASSOCIATION *RHODOTHAMNO-LARICETUM* IN SLOVENIA
RAZŠIRJENOST ASOCIACIJE *RHODOTHAMNO-LARICETUM* V SLOVENIJI

Igor DAKSKOBLER[1], Florjan LEBAN[2], Andrej ROZMAN[3] & Andrej SELIŠKAR[4]

ABSTRACT UDC: 581.55:582.475(234.323.6)
Through field mapping and with colour digital orthophoto images we determined that natural larch stands in Slovenia which are classified into the association *Rhodothamno-Laricetum* and to a habitat type of Community interest (Natura 2000 code: 9420) extend over 3161 hectares, which means 0.3 % of all forest area in Slovenia. They are most common in the Julian Alps, especially in the Trenta Valley, Bohinj and the Upper Sava Valley (2146 ha), in the Kamnik-Savinja Alps, especially in Jezersko and the upper Savinja valley (746 ha). The map, which is available on the Slovenia Forest Service website (http://prostor.zgs.gov.si/pregledovalnik/) and on the Interactive map of Slovenia with databases of ZRC SAZU (http://gis.zrc-sazu.si/zrcgis/), will be helpful above all for foresters and nature conservation services.

Key words: larch forests, *Rhodothamno-Laricetum,* Natura 2000, vegetation map, the Julian Alps, the Kamnik-Savinja Alps, the Karavanke mountains, Slovenia

IZVLEČEK UDK: 581.55:582.475(234.323.6)
S terenskim kartiranjem in s pomočjo barvnih digitalnih ortofoto posnetkov smo ugotovili, da so naravni sestoji macesna v Sloveniji, ki jih uvrščamo v asociacijo *Rhodothamno-Laricetum* in v evropsko varstveno pomemben habitatni tip (Natura 2000 koda: 9420) razširjeni na 3161 ha ali 0,3 % gozdne površine Slovenije. Najbolj pogosti so v Julijskih Alpah, predvsem v Trenti, Bohinju in Zgornji Savski dolini (2146 ha), ter v Kamniško-Savinjskih Alpah, predvsem na Jezerskem in v zgornji Savinjski dolini (746 ha). Naša karta, ki je dostopna na internetnih straneh Zavoda za gozdove Slovenije (http://prostor.zgs.gov.si/pregledovalnik/) in na Interaktivni karti Slovenije z zbirkami ZRC SAZU (http://gis.zrc-sazu.si/zrcgis/), bo v pomoč predvsem gozdarjem in službam za varstvo narave.

Ključne besede: macesnovi gozdovi, *Rhodothamno-Laricetum*, Natura 2000, vegetacijska karta, Julijske Alpe, Kamniško-Savinjske Alpe, Karavanke, Slovenija

[1] Dr. Igor Dakskobler, the Jovan Hadži Institute of Biology of the Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Regional research unit, Brunov drevored 13, 5220 Tolmin, igor.dakskobler@zrc-sazu.si
[2] Florjan Leban, Slovenia Forest Service, Regional unit Tolmin, Tumov drevored 17, 5220 Tolmin, florijan.leban@zgs.gov.si
[3] Dr. Andrej Rozman, Biotechnical Faculty of the University in Ljubljana, Department of Forestry and Renewable Forest Resources, Večna pot 83, 1000 Ljubljana, andrej.rozman@bf.uni-lj.si
[4] Mag. Andrej Seliškar, the Jovan Hadži Institute of Biology of the Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Novi trg 2, 1000 Ljubljana, as@zrc-sazu.si

1 INTRODUCTION

Phytosociological features of natural larch stands in the Julian Alps were presented several years ago when they were classified into the association *Rhodothamno-Laricetum* (Dakskobler 2006). Our findings were supplemented by Zupančič & Žagar (2007). The natural larch community was not considered in the existing vegetation maps of Slovenia (Košir et al. 1974, 2003, Čarni et al. 2002) and its area is included in Alpine dwarf pine community (*Rhodothamno-Rhododendretum hirsuti*). In 2009 and 2010 we thoroughly studied the occurrence of this community in Slovenia in the framework of the target research project Natural larch stands in Slovenia. We made some 140 phytosociological relevés and obtained the data necessary for a presentation of the distribution area of its stands. According to our findings their origin is various. In part they are primary larch sites. These encompass very steep to perpendicular, usually shady rocky slopes in the belt of montane beech and fir-beech forests, and ledges, prominences in rock walls of mountain ridges at the altitude of 1650 to 1850 (1950) m, where beech is unable to grow (Figures 1 and 6). The main characteristic of these sites is that larch occurs in all stand layers and regenerates very well, while other tree species (spruce, mountain ash, in places silver fir, beech and sycamore maple) occur only sporadically and obviously lack the strength to replace larch in the succession. Examples of such primary larch stands are under Čisti vrh, Velika and Mala Tičarica above Spodnja Trenta, in Apica above the mountain pasture Zapotok, Sleme and Robičje above the Mala Pišnica valley, Prednja glava above Suha Pišnica, Macesnje above the Beli potok valley, Na pragu under Šplevta, Kališče, Macesence and Požgana Mlinarica above the Vrata valley, Macesnovec above the Kot valley, Brda above the Krma valley and in some places in the Kamnik-Savinja Alps (e.g. under Veliki vrh and on the ledges of Kočna in Jezersko and under Raduha in Solčavsko). Extensive larch stands that surround pastures on high-mountain plateaus (e.g. a part of Komna and the Triglav Lakes Valley, Velo polje and Fužina pasturelands in Bohinj, the northern part of Pokljuka in the Julian Alps and Veža – the Dleskovška planota plateau in the Savinja Alps) and larch forests in the eastern part of Karavanke mountains (Mts. Peca and Olševa) are probably of a different origin. The primary forest here (that very likely used to be at least partly beech or spruce) must have been cleared or burnt for pasture at one time and the pasture area was much larger than it is today. In the secondary succession larch established itself as a pioneer species that regenerates naturally so there is very little possibility that it could soon be naturally replaced by beech or spruce. These secondary larch forests, especially if they grow on rocky sites and at altitudes above 1600 m (i.e. on or above the existing upper beech line), are usually very similar in their structure and floristic composition to the primary larch forest and are therefore still classified into the same association, *Rhodothamno-Laricetum*. Because differentiating between primary and secondary (pioneer) larch stands in high mountains is very difficult and because of their similar structure and due to the fact that they regenerate very similarly, we took into account the existing situation and mapped them together. As a rule, primary larch forests are not managed forests and have an explicitly protective role. In terms of nature conservation they are defined as a habitat type of European conservation concern, designated as "Alpine *Larix decidua* and/or *Pinus cembra* forests (9420)" in the Habitat Directive. This type has not been considered in Slovenia so far. The Typology of habitat types (Jogan et al. 2004) mentions only Alpine secondary larch formations (Palearctic habitat classification: 42.34). Supple-

Figure 1: Stand of the association Rhodothamno-Laricetum, Na pragu near the peak Brinova glava above the Vrata valley (Photo Andrej Seliškar)
Slika 1: Sestoj asociacije Rhodothamno-Laricetum, Na pragu pri Brinovi glavi nad dolino Vrat (Foto Andrej Seliškar)

mented with new findings the typology will have to include also the habitat type 42.32 "Eastern Alpine calcicolous larch and arolla forests" or "Alpine limestone larch forests (42.322)". As a habitat type of European conservation concern it will have to be included as appropriate into the Natura 2000 regions designated within the Slovenian part of the Alps, also with reference to the prepared distribution map of larch forests.

2 METHODS

The data on larch stands in the Slovenia Forest Service database served as the basis for designing the map of natural larch forests. In this database larch occurs in growing stock on 139,000 hectares. We considered only the stands in the areas of larch natural distribution (the Julian and Kamnik-Savinja Alps with their foothills, the Karavanke, the northern edge of the Trnovski gozd plateau) at altitudes above 1000 m where larch growing stock exceeded 50 m^3/ha and spruce, beech and silver fir growing stock was less than 50 % of the total growing stock of the stands. This map of larch stands was subsequently carefully corrected on the basis of field mapping. In the process we excluded all larch plantations and stands on the sites of beech communities with larch (e.g. *Anemono-Fagetum laricetosum),* spruce with larch (e.g. *Adenostylo glabrae-Piceetum laricetosum)* or Scots pine with larch (*Fraxino orni-Pinetum nigrae pinetosum sylvestris* var. *Larix decidua*). Some 70 % of natural larch stands were examined. On the basis of the data in the field maps and by use of topographic maps, 1: 10.000 and 1:5.000, and colour digital orthophotos (DOFs), we plotted in MapInfo software package larch dominated stands that can be classified into the association *Rhodothamno-Laricetum*. We also performed a cross-section of the plotted areas of these stands with the latest data on land use (the map therefore takes into consideration the existing forest edge). Colour orthophotos were a good tool, especially in delimitation of larch stands on plateaus and gentler slopes. In these orthophotos conifers are clearly distinguished from beech whereas the distinction between larch and spruce (and silver fir) is less evident. The biggest problem when plotting the map were large areas of larch forests on high-mountain plateaus (e.g. Komna, Fužina pasturelands, Velo polje, Pokljuka, Dleskovška planota plateau), where the delimitation between a dwarf pine community with larch (*Rhodothamno-Rhododendretum laricetosum = Rhododendro hirusti-Pinetum mugo laricetosum*) and a larch community was not always clear. In such cases we turned to our previous findings (Dakskobler 2006, Zupančič & Žagar 2007) and classified as the larch community those stands in which larch covered in tree layer more than 30 % of the mapped area.

Analysis of relief characteristics of natural larch stands was made with the IDRISI software package (Eastman 2006). We used the digital elevation model (DEM) of Slovenia (GURS 2005) with a raster cell resolution of 12,5 m. The map of larch stands was converted from vector to raster, which led to a slight discrepancy in the calculation of the larch stand area (≈ 0,1 %). Distribution of altitudes was analysed by mountain ranges and forest management regions in 100-metre altitudinal belts. For the slope of terrain and exposition analysis we used the basic DEM to prepare slope and exposition maps (discretised into 8 cardinal directions).

The authors of the syntaxa mentioned in the article are listed in the Appendix.

3 RESULTS

The natural larch stands classified into the association *Rhodothamno-Laricetum* were determined on the total area of 3161 ha (Tables 1 and 4, Figure 2). Most of them (almost 70 % of the total area) are located in the Julian Alps and the fewest (less than 10 % of the total area) are in the Karavanke mountains. They most frequently occur in the altitudinal belt at 1500–1700 m a.s.l. (Table 2, Figure 3).

Table 1: Area of the stands of the association *Rhodothamno-Laricetum* by moutain ranges in Slovenia
Tabela 1: Površina sestojev asociacije *Rhodothamno-Laricetum* po gorovjih v Sloveniji

Mountain range (Gorovje)	Area in ha (Površina v ha)	Share in % (Delež v %)
Julian Alps (Julijske Alpe)	2146	68
Kamnik-Savinja Alps (Kamniško-Savinjske Alpe)	746	24
Karavanke mountains (Karavanke)	269	8
Total (Skupaj)	3161	100

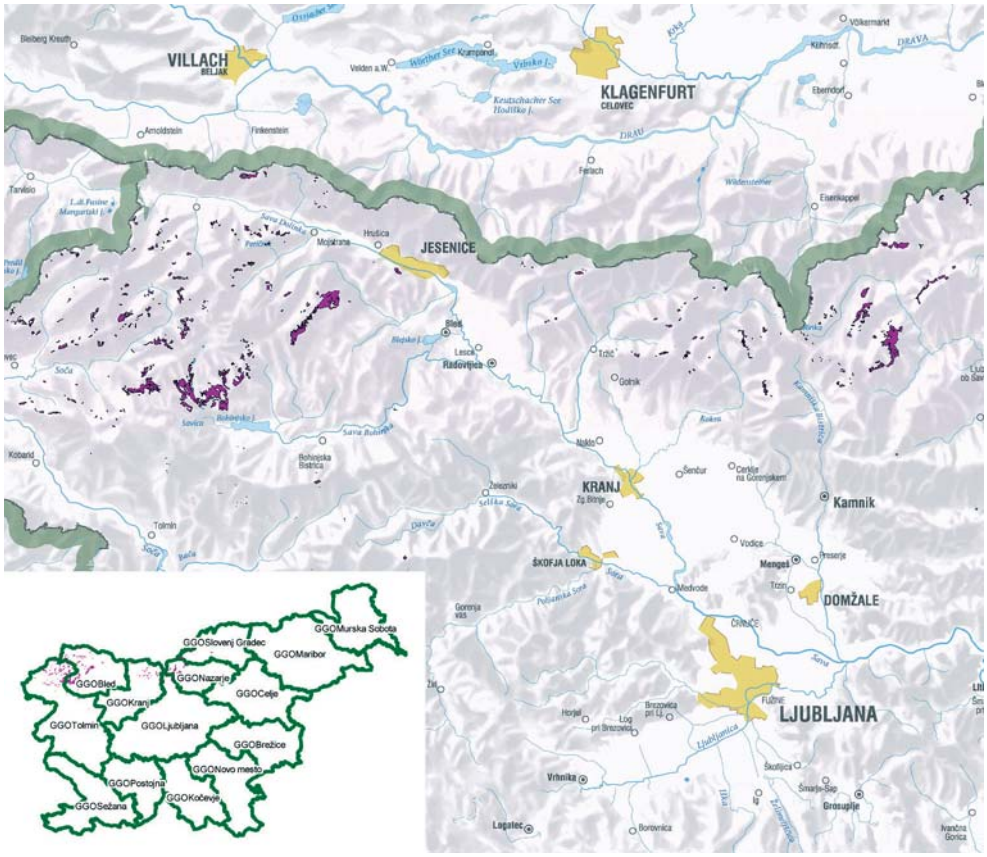

Figure 2: Distribution of the stands of the association Rhodothamno-Laricetum on the map of Slovenia, scale 1: 650000
Slika 2: Razširjenost sestojev asociacije Rhodothamno-Laricetum na zemljevidu Slovenije v merilu 1: 650.000

Altitude

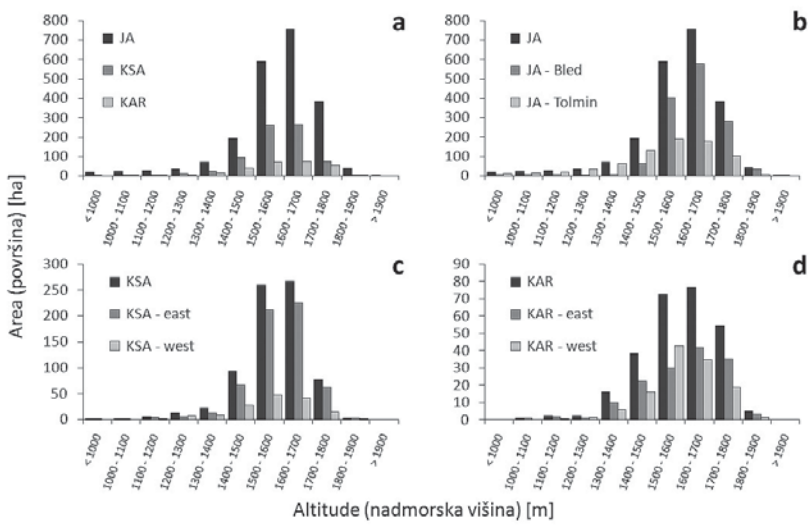

Figure 3: Area of the stands of the association Rhodothamno-Laricetum by 100-metre altitudinal belts (a: total by mountain ranges; b: the Julian Alps; c: the Kamnik-Savinja Alps; d: the Karavanke mountains)
Slika 3: Površina sestojev asociacije Rhodothamno-Laricetum po 100-metrskih višinskih pasovih (a: skupaj po gorovjih; b: Julijske Alpe; c: Kamniško-Savinjske Alpe; d: Karavanke)

Table 2: Area of the stands of the association *Rhodothamno-Laricetum* by 100-metre altitudinal belts
Tabela 2: Površina sestojev asociacije *Rhodothamno-Laricetum* po 100-metrskih višinskih pasovih

	Area in ha (Površina v ha)											
Mountain range (Pogorje)	< 1000	1000-1100	1100-1200	1200-1300	1300-1400	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	> 1900	
Julian Alps	19	24	27	37	71	196	590	756	383	42	0	2146
JA - Tolmin	12	15	20	35	63	132	188	179	102	7	0	752
JA - Bled	7	9	7	2	9	64	402	577	281	35	0	1393
Kamnik-Savinja Alps	0	2	6	14	23	94	260	267	77	4	0	746
KSA - east	0	2	5	7	13	67	212	225	62	3	0	595
KSA - west	0	0	1	7	9	28	48	42	15	1	0	151
Karavanke mountains	0	1	2	3	16	38	73	77	54	5	0	268
KAR - east	0	1	2	1	10	22	30	42	35	3	0	147
KAR - west	0	0	0	1	6	16	43	35	19	1	0	122
Total (Skupaj)	19	27	36	53	110	328	923	1100	514	50	0	3160

Table 3: Area of the stands of the association *Rhodothamno-Laricetum* in forest reserves
Tabela 3: Površina sestojev asociacije *Rhodothamno-Laricetum* v gozdnih rezervatih

Forest reserve (gozdni rezervat)	Manucipality (občina)	Area in ha (površina v ha)
Grušnica	Tolmin	0.63
Visoki Zjabci	Bovec	13.52
Apica	Bovec	14.88
Kukla	Bovec	14.78
Pod Sopotom	Tolmin	0.06
Savica-Ukanc	Bohinj	1.61
Mala Pišnica	Kranjska Gora	25.78
Vršič	Kranjska Gora	26.95
Poljšak	Solčava	0.14
Poljšak	Luče	89.77
Olševa	Črna na Koroškem	49.56
Total (skupaj)		237.67

Table 4: Area of the stands of the association *Rhodothamno-Laricetum* by forest management regions in Slovenia
Tabela 4: Površina sestojev asociacije *Rhodothamno-Laricetum* po gozdnogospodarskih območjih Slovenije

Forest management region	Area in ha	Share in %
Gozdnogospodarsko območje	Površina v ha	Delež v %
Bled	1472	46
Tolmin	752	24
Nazarje	574	18
Kranj	175	6
Slovenj Gradec	168	5
Ljubljana	20	1
Total (Skupaj)	3161	100

Forest reserves comprise 238 ha of larch stands, which constitute 7.5 % of all stands of the association *Rhodothamno-Laricetum* in Slovenia. The larch forest covers 2.5 % of area of all forest reserves in Slovenia (Table 3).

The Bled forest management region comes first as it comprises nearly 50 % of the total area (Table 4). Larger areas of natural larch forests within this region are in Bohinj, on Pokljuka and in the Upper Sava Valley. In Bohinj, between Komna, Fužine pasturelands and Velo polje, there are frequent transitions into the pine dwarf community with larch (*Rhodothamno-Rhododendretum laricetosum*) and their delimitation can be very difficult to establish. Similar is true for Pokljuka, especially for stands above and between pastures Lipanca and Klek. Larger or smaller larch stands, the most primary among the stands surveyed, are located on steep slopes, prominences and ledges above the valleys of Krma, Kot, Vrata, Velika and Mala Pišnica and Tamar (Planica). Smaller areas of natural larch stands are also in the Karavanke part of the Bled region (e.g. in the valleys of Železnica, Belca and Završnica).

The Tolmin forest management region (the Upper Soča Valley, 24 % of the total area) comprises more extensive larch stands on the edge of Komna between the pastures Za Skalo and Za Črnim vrhom, on shady slopes under the Polovnik ridge, under Čisti vrh, Velika and Mala Tičarica above the Lower Trenta and above the

pasture V Plazeh, in Apica above the pasture Zapotok, under Debela peč above Kukla, under Velika glava and Zadnjiški Ozebnik.

The third largest larch region is in the Savinja Alps, in the Nazarje forest management region (18 % of the total area). The most coherent complex is Veža (the Dleskovška planota plateau). A relatively large area of natural larch forest is on shady (northwestern) slopes of Mt. Raduha and under Strelovec and Ute above the Logarska dolina valley, and there are some smaller larch stands also above the Robanov kot and the Matkov kot valleys.

Larch stands in the Kranj forest management region are mostly located in the Tržiška Bistrica river-basin (e.g. Konjščica, Ženikljevec or Veliki Javornik, Štegovnik) and Kokra, including Jezersko (mainly above Makekova and Ravenska Kočna), and in the Ljubljana forest management region in the Kamniška Bistrica river-basin.

In the Slovenj Gradec forest management region, in Koroška (Carinthia), the association *Rhodothamno-Laricetum* comprises larch stands above the valleys of Bistra (under the peaks of Lanež, Jelovec, Greben and Bela peč) and Koprivna (under Mt. Olševa) and smaller stands above the Topla valley (under the Peca range: Greben above Končnik, Mala Peca). The easternmost locality of natural larch forest is on shady slopes under Mt. Uršlja gora (Plešivec).

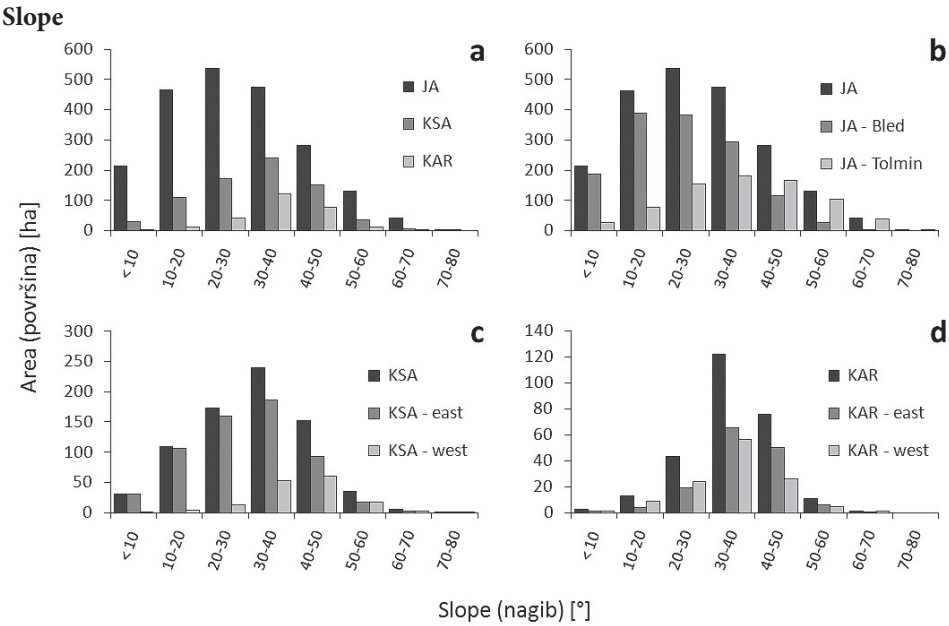

Figure 4: Area of the stands of the association Rhodothamno-Laricetum related to the slope of terrain (a: total by mountain ranges; b: the Julian Alps; c: the Kamnik-Savinja Alps; d: the Karavanke mountains)
Slika 4: Površina sestojev asociacije Rhodothamno-Laricetum glede na nagib terena (a: skupaj po gorovjih; b: Julijske Alpe; c: Kamniško-Savinjske Alpe; d: Karavanke)

Table 5: Area of the stands of the association *Rhodothamno-Laricetum* related to the slope of terrain
Tabela 5: Površina sestojev asociacije *Rhodothamno-Laricetum* glede na nagib terena

Mountain range	Area in ha (Površina v ha)								
(Pogorje)	< 10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	
Julian Alps	213	464	537	473	281	131	43	4	2145
JA - Tolmin	26	76	156	181	165	105	40	4	752
JA - Bled	187	387	381	292	116	26	3	0	1393
Kamnik-Savinja Alps	31	110	172	240	152	35	6	0	746
KSA - east	31	106	159	186	92	17	3	0	595
KSA - west	0	4	13	53	60	18	3	0	151
Karavanke mountains	2	13	43	122	76	11	1	0	268
KAR - east	1	4	19	66	50	6	0	0	147
KAR - west	1	9	24	57	26	5	1	0	122
Total (Skupaj)	246	586	752	835	509	177	50	4	3159

Slope of terrain in Gorenjska (Upper Carniola) in the Julian Alps (Bled forest management region) is slightly smaller than in the Upper Soča Valley (Tolmin forest management region), the Kamnik-Savinja Alps and the Karavanke mountains. Larger areas of larch forests in the Bled forest management region are located on plateaus (Fužina pasturelands, Pokljuka, Vrtaški vrh), so most slopes range between 10° and 30°. Slopes in other regions predominantly range between 20° and 50° (Table 5, Figure 4).

Exposition

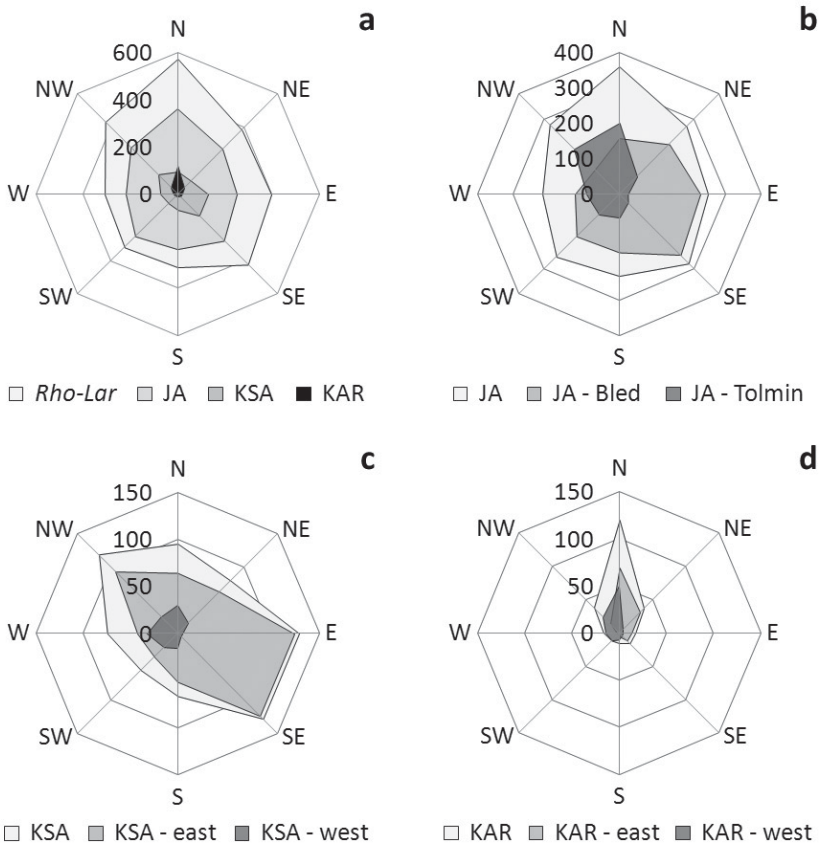

Figure 5: Area of the stands of the association Rhodothamno-Laricetum related to the exposition (a: total by mountain ranges; b: the Julian Alps; c: the Kamnik-Savinja Alps; d: the Karavanke mountains)
Slika 5: Površina sestojev asociacije Rhodothamno-Laricetum glede na ekspozicijo (a: skupaj po gorovjih; b: Julijske Alpe; c: Kamniško-Savinjske Alpe; d: Karavanke)

Table 6: Area of the stands of the association *Rhodothamno-Laricetum* related to the exposition
Tabela 6: Površina sestojev asociacije *Rhodothamno-Laricetum* glede na ekspozicijo

Mountain range	Area in ha (Površina v ha)								
(Pogorje)	N	NE	E	SE	S	SW	W	NW	
Julian Alps	361	271	252	279	232	252	218	279	2144
JA - Tolmin	202	70	24	34	66	81	93	181	751
JA - Bled	159	200	229	245	166	170	125	98	1393
Kamnik-Savinja Alps	95	79	129	128	66	55	75	118	745
KSA - east	64	63	123	123	51	35	42	93	594
KSA - west	31	16	5	5	16	21	32	25	151
Karavanke mountains	120	37	17	16	11	12	17	38	268
KAR - east	69	31	13	11	4	1	3	14	146
KAR - west	51	6	4	4	7	11	14	24	121
Total (Skupaj)	576	386	398	422	310	319	310	436	3157

In general, shady slopes prevail in the stands of the association *Rhodothamno-Laricetum* (Table 6, Figure 5). This is the most obvious in the Karavanke mountains, in the Soča region of the Julian Alps and in the western part of the Kamnik-Savinja Alps. Larch forests in Gorenjska (Upper Carniola) in the Julian Alps and in the Upper Savinja valley grow equally on all expositions as they frequently occur on high mountain plateaus with diverse terrain (e.g. Pokljuka, Veža). Expositions recorded in phytosociological relevés are generally shadier than suggested by the digital terrain model analysis. When selecting relevé plots we were looking for the best preserved natural larch stands, which in all studied regions most frequently occur on steep, shady sites.

4 CONCLUSIONS

The total area of natural larch stands (3161 ha, 0.3 % of total forest area in Slovenia) is far from insignificant also because it is a forest habitat type of European conservation concern. See also Košir (2010: 57–58), who determined similar areas and proportions for the following vegetation types in Slovenia: subalpine beech stands (1825 ha), maple and ash stands (2856 ha), silver fir stands on calcareous bedrock (2458 ha), willow stands (3522 ha) and spruce stages on beech sites (2507 ha). Our map is designed above all for the Slovenia Forest Service (and with their valuable assistance). Our goal is to provide a place in the forest community database for the larch and dwarf alpenrose community (*Rhodothamno-Laricetum*) and to give it a proper evaluation within the protective forest management class in certain forest management regions and units, separately from other protective forests. The map (which is available on Slovenia Forest Service website http://prostor.zgs.gov.si/pregledovalnik/) and on the Interactive map of Slovenia with databases of ZRC SAZU, http://gis.zrc-sazu.si/zrcgis/), at present still incomplete and in need of additional field checking, will be supplemented through further research. We welcome critical response and corrections from foresters in district, local and regional units. We hope it will be of good use to other public services as well, especially to those involved in nature conservation.

5 POVZETEK

Uvod

Fitocenološko podobo naravnih macesnovih sestojev v Julijskih Alpah smo predstavili pred nekaj leti in jih uvrstili v asociacijo *Rhodothamno-Laricetum* (Dakskobler 2006). Naša spoznanja sta dopolnila Zupančič & Žagar (2007). V doslej objavljenih fitocenoloških kartah Slovenije (Košir et al. 1974, 2003, Čarni et al. 2002) macesnove združbe niso upoštevali in so njene površine zaobsežene v površinah alpskega ruševja (*Rhodothamno-Rhododendretum hirsuti*). V letih 2009 in 2010 smo v okviru Ciljnega raziskovalnega projekta Naravni sestoji macesna v Sloveniji podrobno raziskali pojavljanje te združbe v Sloveniji, naredili okoli 140 fitocenoloških popisov in pridobili potrebne podatke za površinski prikaz razširjenosti njenih sestojev. Njihov izvor je po naših spoznanjih različen. Deloma so to primarna macesnova rastišča. Vanje uvrščamo zelo strma do prepadna, navadno osojna skalnata pobočja v pasu gorskih bukovih in jelovo-bukovih gozdov in police, pomole v ostenjih gorskih grebenov, na nadmorski višini od 1650 do 1850 (1950) m, kjer bukev ne more več uspevati (sliki 1 in 6). Glavna značilnost teh rastišč je, da se na njih macesen pojavlja v vseh sestojnih plasteh, se odlično pomlajuje, druge drevesne vrste (smreka, jerebika, ponekod jelka, bukev in gorski javor) se pojavljajo le posamično in očitno nimajo moči, da bi macesen v sukcesiji izpodrinile. Primeri takih primarnih macesnovih sestojev so pod Čistim vrhom, Veliko in Malo Tičarico nad Spodnjo Trento, v Apici nad planino Zapotok, nad dolino Male Pišnice (pod Slemenom in pod Robičjem), nad Suho Pišnico (Prednja glava), nad dolino Belega potoka (Macesnje pod Votlim Slemenom), nad dolino Vrat (Na pragu pod Šplevto, Kališče, Macesence pod Stenarjem, Požgana Mlinarica), nad Kotom (Macesnovec), nad Krmo (pod Brdom) in ponekod v Savinjskih Alpah (npr. pod Velikim vrhom in na policah Kočne na Jezerskem in pod Raduho na Solčavskem). Nekoliko drugačen izvor imajo najbrž obsežna macesnovja, ki obdajajo pašne planine na visokogorskih planotah (npr. del Komne in doline Triglavskih jezer, Velo polje in Fužinske planine v Bohinju in severni del Pokljuke v Julijskih ter Veža v Savinjskih Alpah), tudi macesnovi gozdovi v vzhodnem delu Karavank (Peca, Olševa). Nedvomno je bil tu prvotni gozd (vsaj deloma najbrž bukov ali smrekov) nekoč izkrčen ali požgan za pašo, površina pašnikov pa precej

večja, kot je zdaj. V drugotni sukcesiji se je kot pionir uveljavil macesen, ki se tudi naravno obnavlja in je po naravni poti le malo možnosti, da bi ga bukev in smreka kmalu izpodrinila. Ti drugotni macesnovi gozdovi, še posebej če uspevajo na skalnatih rastiščih in na nadmorski višini nad 1600 m (torej ob ali nad zdajšnjo zgornjo mejo uspevanja bukve), so po zgradbi in floristični sestavi navadno precej podobni primarnemu macesnovemu gozdu, zato jih še vedno uvrščamo v isto asociacijo, *Rhodothamno-Laricetum*. Ker je razlikovanje med primarnimi in drugotnimi (pionirskimi) macesnovimi sestoji v visokogorju precej težavno, ker je njihova zgradba podobna in ker očitno delujejo (se obnavljajo) zelo podobno, smo upoštevali zdajšnje stanje in jih kartirali skupaj. Primarni macesnovi gozdovi praviloma niso gospodarski gozdovi in imajo izrazito varovalno vlogo. Za varstvo narave so opredeljeni kot evropsko pomemben habitatni tip, ki je v habitatni direktivi označen kot »Alpinski gozdovi s prevladujočim macesnom (*Larix decidua*) in/ali cemprinom (*Pinus cembra*) (9420)«. V Sloveniji do zdaj ta habitatni tip ni bil upoštevan. V Tipologiji habitatnih tipov (Jogan et al. 2004) je omenjeno samo sekundarno alpsko macesnovje (Palearktična klasifikacija: 42.34). V dopolnjeni tipologiji bo na podlagi novih spoznanj potrebno dodati še habitatni tip 42.32 »Vzhodnoalpska naravna macesnovja na karbonatni podlagi« oziroma »Alpska macesnovja na karbonatni podlagi (42.322)«. Kot evropsko pomemben habitatni tip ga bo potrebno, tudi na podlagi izdelane karte razširjenosti macesnovih gozdov, smiselno vključiti v območja Natura 2000, ki so proglašena v območju slovenskega dela Alp.

Metode

Izhodišče pri izdelavi zemljevida naravnih macesnovih sestojev so bili podatki o sestojih v bazi Zavoda za gozdove Slovenije. Macesen se v tej bazi pojavlja v lesni zalogi na 139.000 ha. Upoštevali smo le sestoje v območjih naravne razširjenosti macesna (Julijske in Kamniško-Savinjske Alpe s prigorjem, Karavanke, severni rob Trnovskega gozda), na nadmorski višini nad 1000 m, v katerih je bila lesna zaloga macesna več kot 50 m^3/ha, lesna zaloga smreke, bukve in jelke pa manjša od 50 % celotne lesne zaloge sestojev. Tako pridobljeno karto macesnovih sestojev smo temeljito popravili na podlagi terenskega kartiranja in izločili vse macesnove nasade in sestoje na rastiščih združb bukve z macesnom (npr. *Anemono-Fagetum laricetosum*), smreke z macesnom (npr. *Adenostylo glabrae-Piceetum laricetosum*) ali rdečega bora z macesnom (*Fraxino orni-Pinetum nigrae pinetosum sylvestris* var. *Larix decidua*). Na terenu smo pregledali okoli 70 % naravnih macesnovih sestojev. Na podlagi terenskih kart in s pomočjo podrobnih zemljevidov v merilu 1: 10 000 in 1. 5 000 ter barvnih digitalnih ortofoto posnetkov (DOF-ov) smo v programu MapInfo izrisali sestoje, v katerih je macesen dominantna vrsta in ki jih lahko uvrstimo v asociacijo *Rhodothamno-Laricetum*. Izvedli smo tudi presek izrisa površin teh sestojev z najnovejšimi podatki rabe tal (torej je na zemljevidu upoštevan dejanski gozdni rob). Barvni ortofoto posnetki so bili dober pripomoček predvsem za omejitev macesnovih sestojev na planotah in položnejših pobočjih. Na njih se dobro ločijo iglavci od bukve, nekoliko težje pa je razlikovati macesen od smreke (in jelke). Največja težava pri risanju karte so bile obsežne površine macesnovih gozdov na visokogorskih planotah (npr. Komna, Fužinske planine, Velo polje, Pokljuka, Dleskovška planota), kjer je bilo včasih težko potegniti mejo med združbo rušja z macesnom (*Rhodothamno-Rhododendretum laricetosum* = *Rhododendro hirusti-Pinetum mugo laricetosum*) in macesnovo združbo. V takih primerih smo skladno s spoznanji prejšnjih let (Dakskobler 2006, Zupančič & Žagar 2007) v macesnovo združbo uvrstili tiste sestoje, kjer je macesen v drevesni plasti zastiral več kot 30 % površine. Analizo reliefnih značilnosti naravnih macesnovih sestojev smo opravili s programskim paketom IDRISI (Eastman 2006). Uporabili smo digitalni model višin (DMV) Slovenije (GURS 2005) z ločljivostjo rastrske celice 12,5 m. Karto macesnovih sestojev smo iz vektorske oblike pretvorili v rastersko, pri čemer je prišlo do malenkostnega odstopanja v izračunu površine macesnovih sestojev (≈ 0,1 %). Analizirali smo porazdelitev nadmorskih višin po pogorjih in gozdnogospodarskih območjih v 100-metrskih višinskih pasovih. Za analizo nagiba terena in ekspozicije smo iz osnovne karte digitalnega modela višin (DMV) pripravili karti nagibov in ekspozicij (diskretizirana v osem glavnih smeri neba).

Avtorje v članku omenjenih sintaksonov navajamo v dodatku.

Rezultati

Naravne sestoje macesna, ki jih uvrščamo v asociacijo *Rhodothamno-Laricetum*, smo ugotovili na skupni površini 3161 ha (tabeli 1 in 4, slika 2). Največ (skoraj 70 % skupne površine) jih je v Julijskih Alpah, najmanj (manj kot 10 % skupne površine) pa v Karavankah. Najpogosteje se pojavljajo v višinskem pasu od 1500–1700 m (tabela 2, slika 3). V gozdne rezervate je vključeno 238 ha macesnovih sestojev, kar je 7,5 % vseh sestojev asociacije *Rhodothamno-Laricetum* v Sloveniji. Macesnov gozd porašča 2,5 % površine vseh gozdnih rezervatov v Sloveniji (tabela 3).

Po gozdnogospodarskih območjih (tabela 4) je na prvem mestu blejsko (skoraj 50 % skupne površine). V tem območju so večje površine naravnih macesnovih gozdov v Bohinju, na Pokljuki in v Zgornji Savski dolini. V Bohinju, med Komno, Fužinskimi planinami in Velim poljem, so zelo pogosti prehodi v združbo ruševje z macesnom (*Rhodothamno-Rhododendretum laricetosum*) in razmejitev je ponekod precej težavna. Podobno velja za Pokljuko, predvsem za sestoje nad in med planinama Lipanca in Klek. Večji ali manjši macesnovi sestoji, med vsemi pregledanimi najbolj prvobitni, so na strmih pobočjih, pomolih in policah nad dolinami Krme, Kota, Vrat, Velike in Male Pišnice ter Tamarja (Planice). Manjše površine naravnih macesnovih sestojev so tudi v karavanškem delu blejskega območja (npr. v dolinah Železnice, Belce in Završnice).

V tolminskem gozdnogospodarskem območju (Zgornje Posočje, 24 % skupne površine) so obsežnejši macesnovi sestoji na robu Komne med planinama Za Skalo in Za Črnim vrhom, na osojnih pobočjih pod grebenom Polovnika, pod Čistim vrhom, Veliko in Malo Tičarico nad Spodnjo Trento in nad planino V Plazeh, v Apici nad planino Zapotok, pod Debelo pečjo nad Kuklo, pod Veliko glavo in Zadnjiškim Ozebnikom .

Tretje največje macesnovo območje je v Savinjskih Alpah, v nazarskem gozdnogospodarskem območju (18 % skupne površine). Najbolj sklenjen kompleks je Veža (Dleskovška planota). Razmeroma velika površina naravnega macesnovega gozda je na osojnih (severozahodnih) pobočjih Raduhe in pod Strelovcem in Utami nad Logarsko dolino, manjši macesnovi sestoji so tudi nad Robanovim in Matkovim kotom.

V kranjskem gozdnogospodarskem območju imajo naravne macesnove gozdove predvsem v povodju Tržiške Bistrice (npr. Konjščica, Ženikljevec oz. Veliki Javornik, Štegovnik) in Kokre, vključno z Jezerskim (predvsem nad Makekovo in Ravensko Kočno), v ljubljanskem gozdnogospodarskem območju pa v povodju Kamniške Bistrice.

V slovenjegraškem gozdnogospodarskem območju, na Koroškem, smo v asociacijo *Rhodothamno-Laricetum* uvrstili macesnove sestoje nad dolinama Bistre (pod Lanežem, Jelovcem, Grebenom in Belo pečjo) in Koprivne (pod Olševo) ter manjše sestoje nad dolino Tople (Greben nad Končnikom, Mala Peca). Najbolj vzhodno nahajališče naravnega macesnovega gozda je na osojah pod Uršljo goro (Plešivcem).

Nagib (naklon) terena (slika 4, tabela 5) je v gorenjskem delu Julijskih Alp (GGO Bled) nekoliko manjši kot v Zgornjem Posočju (GGO Tolmin) ter v Kamniško-Savinjskih Alpah in Karavankah. V blejskem gozdnogospodarskem območju so večja območja macesnovih gozdov na planotah (Fužinske planine, Pokljuka, Vrtaški vrh), zato prevladujejo nagibi med 10° in 30°. Na drugih območjih prevladujejo nagibi med 20° in 50°.

V sestojih asociacije *Rhodothamno-Laricetum* v splošnem prevladujejo osojne lege (slika 5, tabela 6). To je najbolj očitno v Karavankah, v posoškem delu Julijskih Alp in v zahodnem delu Kamniško-Savinjskih Alp. V gorenjskem delu Julijskih Alp in Zgornji Savinjski dolini macesnovi gozdovi precej enakomerno uspevajo v vseh legah, saj so pogosti na visokogorskih planotah z razgibanim površjem (npr. Pokljuka, Veža). Pri fitocenoloških popisih so ekspozicije v splošnem bolj osojne kot to kaže analiza digitalnega modela reliefa. Pri izbiri popisnih ploskev smo iskali čim bolj ohranjene naravne macesnove sestoje, teh pa je v vseh obravnavanih območjih največ na strmih osojnih legah.

Zaključki

Skupna površina naravnega macesnovja (3161 ha, 0, 3 % od skupne gozdne površine Slovenije) ni zanemarljiva, tudi zato, ker je to evropsko varstveno pomemben gozdni habitatni tip. Za primerjavo, Košir (2010: 57–58) ugotavlja za Slovenijo podobne površine in deleže za naslednje vegetacijske tipe: subalpinsko bukovje (1825 ha), javorovja in jesenovja (2856 ha), jelovja na karbonatni podlagi (2458 ha), vrbovja (3522 ha) in smrekove stadije na bukovih rastiščih (2507 ha). Naša karta je predvsem namenjena Zavodu za gozdove Slovenije (s čigar dragoceno pomočjo je tudi nastala). Želimo, da bi združba macesna in slečnika (*Rhodothamno-Laricetum*) dobila mesto v bazi gozdnih združb in da bi ga v okviru gospodarskega razreda varovalnih gozdov v nekaterih gozdnogospodarskih območjih in v nekaterih gozdnogospodarskih enotah ustrezno obravnavali, ločeno od ostalih varovalnih gozdov. Zemljevid (dostopen je na internetnih straneh Zavoda za gozdove Slovenije, http://prostor.zgs.gov.si/pregledovalnik/) in na Interaktivni karti Slovenije z zbirkami ZRC SAZU, http://gis.zrc-sazu.si/zrcgis/), ki je zdaj še precej nepopoln in potrebuje dodatna terenska preverjanja, bomo z nadaljnjimi raziskavami dopolnjevali in pri tem pričakujemo kritičen odziv in popravke gozdarjev v revirjih, krajevnih in območnih enotah. Upamo, da ga bodo s pridom uporabljale tudi druge javne službe, predvsem s področja varstva narave.

ACKNOWLEDGEMENT

The research was conducted within the target research project Natural larch stands in Slovenia (V4-0542), funded by the Slovenian Research Agency and Ministry of Agriculture, Forestry and Food. During our field mapping we were occasionally accompanied and guided by Iztok Mlekuž, Tone Kravanja, Edvin Kravanja, Branko Zupan, Ivan Veber, Dr. Miran Čas and Dr. Branko Vreš. Academician Dr. Mitja Zupančič, Mag. Martin Šolar, Vida Papler-Lampe, Alfred Grilc, Kostja Jerovšek, Vili Potočnik, Igor Nahtigal, Maša Tenčić and Anton Kladnik helped with their advice. We are indebted to Dr. Lado Kutnar, who reviewed our article and contributed valuable additions and improvements. English translation by Andreja Šalamon Verbič.

REFERENCES – LITERATURA

Čarni, A., L. Marinček, A. Seliškar & M. Zupančič, 2002: *Vegetacijska karta gozdnih združb Slovenije 1. 400.000*. Biološki inštitut Jovana Hadžija, ZRC SAZU.

Dakskobler, I., 2006: *Asociacija Rhodothamno-Laricetum (Zukrigl 1973) Willner & Zukrigl 1999 v Julijskih Alpah. The Association Rhodothamno-Laricetum (Zukrigl 1973) Willner & Zukrigl 1999 in the Julian Alps*. Razprave 4. razreda SAZU (Ljubljana) 47–1: 117–192.

Direktiva Sveta 92/43/EGS z dne 21. maja 1992 o ohranjanju naravnih habitatov ter prosto živečih živalskih in rastlinskih vrst (Uradni list L 206 z dne 22.07.1992, str. 7).

Eastman, J.R., 2006: *IDRISI Andes.* Clark University, Worcester, MA.

Gurs, 2005: *Digitalni model višin DMV12,5*. Geodetska uprava RS, Ljubljana.

Jogan, N., M. Kaligarič, I. Leskovar, A. Seliškar & J. Dobravec, 2004: *Habitatni tipi Slovenije HTS 2004*. Agencija Republike Slovenije za okolje, Ljubljana.

Košir, Ž., 2010: *Lastnosti gozdnih združb kot osnova za gospodarjenje po meri narave*. Zveza gozdarskih društev Slovenije, Gozdarska založba, Ljubljana.

Košir, Ž., M. Zorn-Pogorelc, J. Kalan, L. Marinček, I. Smole, L. Čampa, M. Šolar, B. Anko, M. Accetto, D. Robič, V. Toman, L. Žgajnar & N. Torelli, 1974: *Gozdnovegetacijska karta Slovenije, M 1:100.000*. Biro za gozdarsko načrtovanje, Ljubljana.

Košir, Ž., M. Zorn-Pogorelc, J. Kalan, L. Marinček, I. Smole, L, Čampa, M. Šolar, B. Anko, M. Accetto, D. Robič, V. Toman, L. Žgajnar, N. Torelli, I. Tavčar, L.,Kutnar, A. Kralj, 2003: *Gozdnovegetacijska karta Slovenije. M 1:100 000.* Gozdarski inštitut Slovenije, Ljubljana.

Ptney Bowes Software inc., 2009: *MapInfo*, One Global View, Troy, NY.

Zupančič, M. & V. Žagar, 2007: *Comparative analysis of phytocoenoses with larch (Rhodothamno-Rhododendretum var. geogr. Paederota lutea laricetosum, Rhodothamno-Laricetum).* Razprave 4. razreda SAZU (Ljubljana) 48 (2): 307–335.

APPENDIX –DODATEK

List of syntaxa with their authors – Seznam sintaksonov z njihovimi avtorji:

Anemono trifoliae-Fagetum Tregubov 1962 *laricetosum* Tregubov 1962

Adenostylo glabrae-Piceetum M. Wraber ex Zukrigl 1973 corr. Zupančič 1999 *laricetosum* Zupančič 1999

Rhodothamno-Laricetum Willner et Zukrigl 1999

Rhodothamno-Rhododendretum hirsuti (Aichinger 1933) Br.-Bl. & Sissingh in Br.-Bl. & al. 1939 *laricetosum* Tregubov 1962 = *Rhododendro hirsuti-Pinetum prostratae* Zöttl 1951 *laricetosum* Tregubov 1962

Fraxino orni-Pinetum nigrae Martin-Bosse 1967 *pinetosum sylvestris* T. Wraber 1979 var. *Larix decidua* Dakskobler 2006

Figure 6: Stand of the association Rhodothamno-Laricetum, Macesnovec above the Kot valley (Photo Andrej Seliškar)
Slika 6: Sestoj asociacije Rhodothamno-Laricetum, Macesnovec nad Kotom (Foto Andrej Seliškar)