ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume LX 14 Number 1, 2012

GROWTH OF SILVER FIR (*ABIES ALBA* MILL.) ON ORIGINALLY AGRICULTURAL LAND IN THE REGION OF THE WHITE CARPATHIANS

J. Simon, Z. Adamec

Received: April 27, 2011

Abstract

SIMON, J., ADAMEC, Z.: *Growth of silver fir (Abies alba Mill.) on originally agricultural land in the region of the White Carpathians.* Acta univ. agric. et silvic. Mendel. Brun., 2012, LX, No. 1, pp. 111–116

At the Ploščiny-Triangl locality belonging to the northernmost part of the CHKO Bílé Karpaty (Protected Landscape Area White Carpathians), altitude 739 m, typological unit – Nutrient Rich Fir-Beech Forest, comparative analysis was carried out of selected biometrical quantities of the time series of stands originated on former agricultural land and stands originated by the alternation of forest generations. On the basis of examinations it is possible to formulate following conclusions:

- the height increment culmination occurs at stands originated on former agricultural land earlier, viz. at an age of about 20 years;
- on the other hand, the culmination of volume increment related to a mean stem occurs later, at current increment at an age of 80 years, at a mean increment at an age of 140 years;
- the growth curve of a mean stand height of both variants is analogical up to an age of about 20–25 years, further values of stands established on former agricultural land are lower approaching an asymptote of 30 m;
- stands of both variants do not show symptoms of rot or other damage to the reference period of about 150 years.

As for the current condition of natural regeneration of silver fir and succession distribution on unused agricultural land it is possible to state that it is considerably reduced on the basis of intensive pressure of particularly red deer.

silver fir, growth and increment, former agricultural land

Silver fir (*Abies alba* Mill.) is a species belonging to the natural species composition of forests in the CR. A natural proportion of 19.8% (MUSIL, HAMERNÍK, 2007) decreased due to various effects to present about 1%. In the region of the White Carpathians, silver fir is naturally distributed only in a smaller northern part, which is unique by a fact that it creates the southern limit of the silver fir distribution in the Moravian Carpathians (VOLAŘÍK, 2006). Historically, in the period of the last century, unwooded hills and hillsides in the area of White Carpathians, when the character of the Carpathian flysch did not make possible to establish fields, were used as meadows and pastures (KUČA, MÁJSKÝ, KOPEČEK, JONGEPIEROVÁ, 1992). On the ground of social changes and decreasing the effectiveness of agriculture and abandoning agricultural land, mosaic forest invasion occurred gradually on these areas due to secondary succession. This aspect affected changes in biodiversity and, at the same time, has caused a fact that it is possible to find here (regions with the natural occurrence of silver fir – ValašskoKloboučsko, Brumovsko) silver fir stands or stands with an admixture of fir originated partly in the process of changing forest generations and partly on former agricultural land. Stands originated or established on former agricultural land show, owing to the natural particularly soil environment, symptoms of physiological stress manifesting themselves by the increased occurrence of rots, decreased static stability and generally

different characteristics of the growth of biometric quantities (SCHÜTT, 1994; VACEK, SIMON *et al.*, 2009). Statements mentioned above are not always sufficiently proved particularly for that reason that growth analyses of stands established or originated on former agricultural land are not always available (e.g. ŠTEFANČÍK, KAMENSKÝ, 2009). On this account, monitoring was carried out in the area of the White Carpathians with a view to contribute to the problems.

MATERIAL AND METHODS

Analysed area

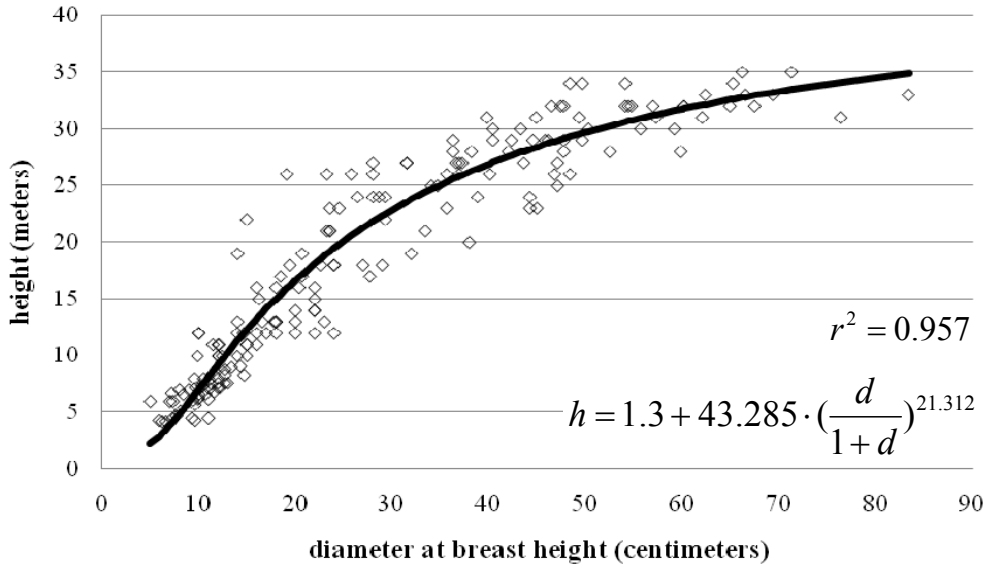
The analysed area is situated in the northernmost part of the White Carpathians Protected Landscape Area, an area with the natural occurrence of silver fir (PRUDIČ, 1990). It is created by the ridge part to the line of tops of Jeleňovská (alt. 663 m), Královec (alt. 665 m), Ploščina (alt. 739 m) situated SW-NE with slopes towards agglomerations of Valašské Klobouky (alt. 379 m) and Brumov-Bylnice. The area is situated in the flysch zone of the Western Carpathians belonging to the Magura sheet group with the typical alternation of sandstone and claystone layers (CHLUPÁČ, 2002). Cambisols are a predominating soil type. The ridge part of the area can be ranked among cold regions (QUITT, 1975) with annual precipitation 825 mm and a mean annual temperature of 6 °C. Typologically, forest type groups 4B Fagetum eutrophicum (Nutrient-rich Beech) and 5B Abieto – Fagetum eutrophicum are dominant there within beech and fir-beech forest vegetation zone; at the lowest locations, then 3 B – Querceto – Fagetum eutrophicum (Nutrient-rich Oak – Beech with silver fir).

Methodology

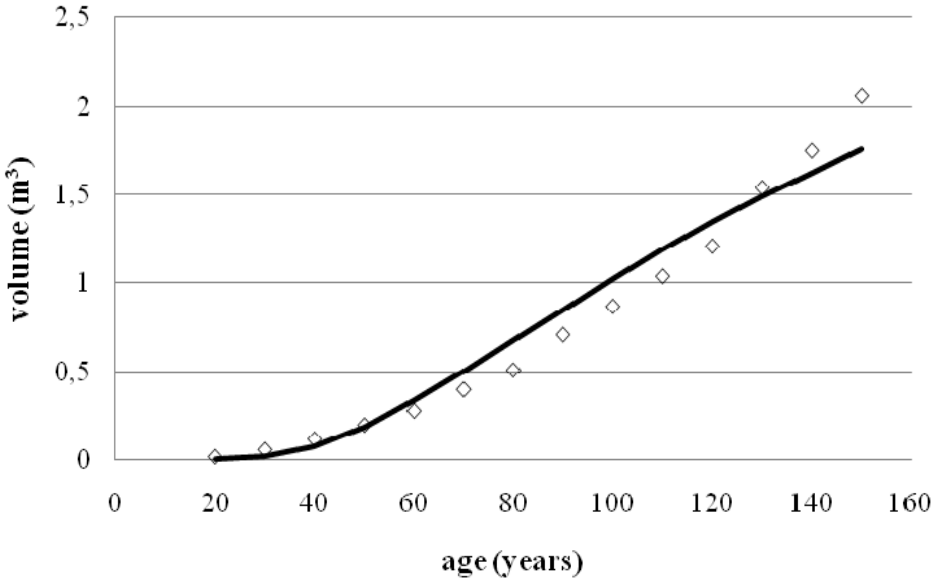
An experimental plot localized in the top part of the Ploščina-Triangl locality served as a basis for analyses. The plot was established in 1988 as part of a monitoring system for the area of White Carpathians – North. In total 50 silver fir trees were evaluated there in advance regeneration with the input age of 18 years. Evaluations with an interval of 5–10 years were realized for a period of 20 years until 2010. Basic growth parameters were evaluated according to standard procedures (DRÁPELA, SIMON, 2010). In the period 1988–1993, crown parameters and annual shoot increments (SIMON *et al.*, 1996) were also evaluated. Data were completed for age ≥ 40 years by values from the description of stands (standard mensurational methods) on a spurious series of stands from a locality defined on a comparable typological unit – 5B – nutrient rich Fir Beech (Abieto – Fagetum eutrophicum). Growth curves were then derived collectively for the value of a mean height and the mean stem volume. Dependences obtained were compared with biometric standards for comparable stands (particularly min. 80% silver fir proportion), stands originated by the alternation of forest generations.

RESULTS AND DISCUSSION

The origin of silver fir stands and stands with an admixture of silver fir at changing the stands and successions on open areas is very limited in this area in recent twenty to thirty years. This fact is not given by natural conditions, which are suitable but by considerable pressure particularly of red deer (ČERMÁK, 2009, unpublished), which is a general phenomenon in the Carpathian region (VRŠKA, ADAM, HORT, KOLÁŘ, JANÍK, 2009). Thus, stands mentioned at the locality originated on



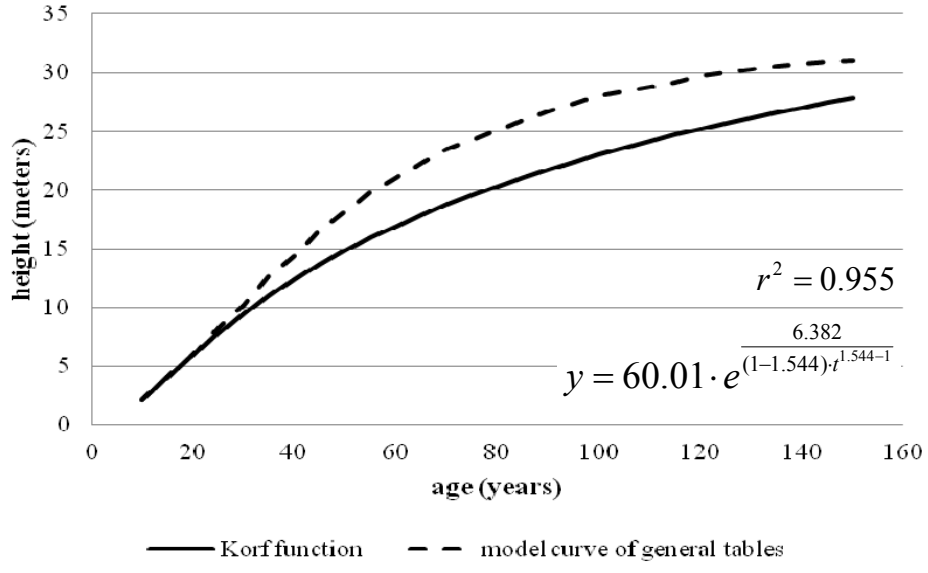
1: *Height curve of the time series of silver fir stands (Abies alba Mill.) in the area of Královec-Ploščina (Levakovič function)*



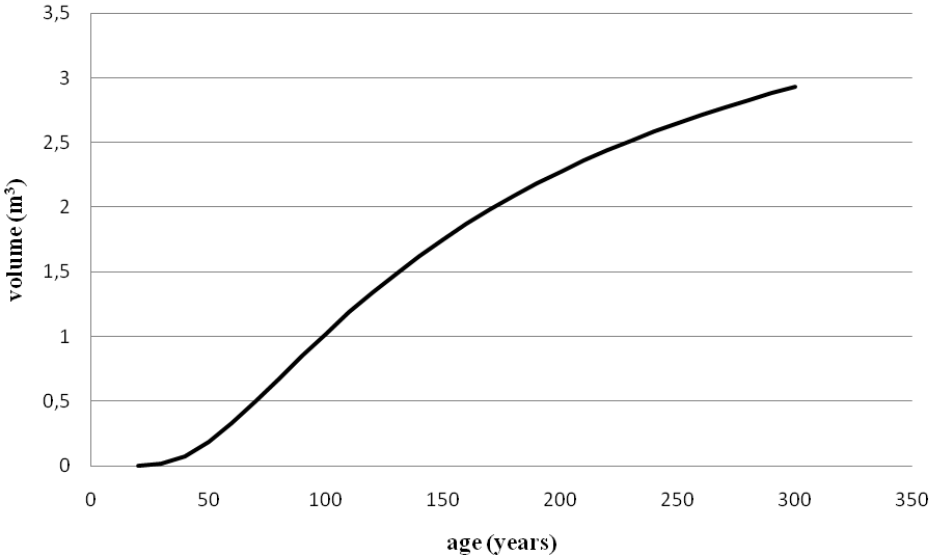
2: *Development of the value of the mean stem volume of the time series of silver fir stands (Abies alba Mill.) in the area of Královec-Ploščina (Korf function)*

I: *Crown parameters of a silver fir (Abies alba Mill.) stand in the area of Ploščina-Triangl in the stage of a young growth*

Year of measurement	Age	Diameter			Height			Green crown width (ŠZK)		Height ŠZK max.		Length of a terminal annual ring		Number of needle years	
		d.b.h. (cm)	s_x	s^2	h (m)	s_x	s^2	ŠZK (m)	s_x	$h_{ŠZK}$ (m)	s_x	l_T (cm)	s_x	N (pcs)	s_x
1988	18	-	-	-	5.4	1.4	24.8	-	-	-	-	-	-	-	-
1989	19	-	-	-	5.7	1.4	23.8	-	-	-	-	40.6	11.3	-	-
1990	20	9.5	2.05	21.6	6.4	1.2	18.9	3.5	0.6	2.4	0.9	42.8	12.8	5.3	0.7
1991	21	10.7	2.06	19.3	6.7	1.5	21.9	3.3	0.5	2.3	0.7	38.9	17.2	6.1	0.5
1992	22	-	-	-	6.9	1.4	19.9	-	-	-	-	37.8	10.6	-	-
1993	23	11.3	2.36	20.8	7.3	1.5	19.9	3.7	0.6	2.5	0.9	28.1	9.2	7.2	0.6



3: *Comparing the height growth curve of a time series of silver fir (Abies alba Mill.) on the area of Královec-Ploščina (Korf function) and the model curve of general tables*



4: *Growth curve of the mean stem volume of silver fir (Abies alba Mill.) on the area of Královec-Ploščina (Korf function)*

former agricultural land are one of little occurring fragments there. From the aspect of the growth of height values (Tab. I, Figs. 1 and 2) they reach values of an absolute height quality AVB = 24, i.e. mean stand height about 24 m at an age of 100 years is supposed.

Culmination of the current increment of the mean stand height is then achieved at an age of 20 year, i.e. earlier than mentioned in literature, e.g. GERHRDT (1930), ASSMANN (1969) – 40 years, MUSIL, HAMERNÍK (2007) – 35 years, for stands originated by the forest alternation although not in all cases. METTE, ALBRECHT, AMMER, BIBER, KOHNLE, PRETZSCH (2009) mention a value of 20 years for the region of SE Germany. The comparison of a growth curve, mean stand curve from carried out analyses and generally used models derived from the level of commonly utilized growth tables is given in Fig. 3.

It is possible to mention that the height growth is roughly analogical up to an age of 20–25 years. A stand originated on former agricultural land shows then less dynamic increment (a difference in height at an age of 100 years can reach a value of 5 m). The expected maximum height of a mean stem should approach a value of 30 m. It is possible to suppose that the factor can be caused by different stand conditions, the character and structure of stands and particularly by soil conditions on former agricultural land. From the aspect of evaluating the volume increment of a mean stem (Fig. 4) it is possible to state values of the current increment culmination (BP_V) at an age of 80 years, mean increment (PP_V) at an age of 140 years. The values are higher than at comparative models, e.g. ASSMANN (1969) – 60 and 110 years, MUSIL, HAMERNÍK (2007) – 55–65 and 110 years.

CONCLUSION

On the basis of comparing a series of stands originated on former agricultural land and stands originated at alternating the forest generations it is possible to deduce following conclusions:

- the height increment culmination occurs at stands on former agricultural land earlier, namely at an age of about 20 years;
- on the other hand, the volume increment culmination related to a mean stem occurs later, viz. at a current increment at an age of 80 years, at an average increment at an age of 140 years;
- growth curve of the mean stand height of both variants is analogical up to an age of about 20–25 years, later values at stands established on former agricultural land are lower approaching an asymptote 30 m;
- stands of both variants do not show symptoms of rot or other damage to the reference period of about 150 years.

Natural regeneration of silver fir at the locality is intensively reduced in recent about 20–30 years, particularly by red deer.

SUMMARY

The paper deals with problems of comparing the growth and increment of basic mensurational quantities of stands predominated by silver fir (*Abies alba* Mill.) originated partly on former agricultural land and in part at alternating generations of forest. Time series of both categories differ from the

aspect mentioned above. From the point of view of evaluating the mean stand height it is possible to state a well-balanced development until about 20–25 years. Further, stands on former agricultural land show lower growth and increment, which culminates later, namely about 20–30 years. The occurrence of rots and decreased stability of stands has not been, however, proved. Another origin of stands on agricultural land as well as the region of natural regeneration are very limited in the area of the northern part of White Carpathians, namely on the ground of intensive pressure of game.

REFERENCES

ASSMANN, E., 1969: Nauka o výnose lesa. Bratislava. Príroda. 448 s.

DRÁPELA, K., SIMON, J., 2010: Stav, struktura a vývoj dřevinného patra. 145–215. In: SIMON, J. a kol., 2010: Strategie managementu lesních území se zvláštním statutem ochrany. Praha. Lesnická práce, s.r.o., 567 s. ISBN 978-80-87154-50-2.

CHLUPÁČ, I., 2002: Geologická minulost České republiky. Praha: Academia.

KORPEĽ, Š., VINŠ, B., 1966: Pestovanie jedle. Bratislava. Slovenské vydavateľstvo pódohospodárskej literatury. 340 s.

KRAMMER, H., 1988: Waldwachstumslehre. Verlag Paul Parey. Hamburg und Berlin. 374 s. ISBN 3-490-05616-7.

KUČA, P., MÁJSKÝ, J., KOPEČEK, F., JONGEPIEROVÁ, I., 1992: CHKO Bílé Karpaty. Bratislava. Ekologia, 380 s. ISBN 80-85559-09-9.

METTE, T., ALBRECHT, A., AMMER, CH., BIBER, P., KONHLE, U., PRETZSCH, H., 2009: Evaluation of the forest growth simulator SILVA on dominant trees in nature mixed Silver fir-Norway spruce stands in South-west Germany. Ecological modeling 220: 1670–1680.

MUSIL, I., HAMERNÍK, J., 2007: Jehličnaté dřeviny. Praha. Academia.: 141–153. ISBN 978-80-200-1567-9.

NEUHÖFEROVÁ, P. (eds), 2005: Jedle bělokorá – 2005. Sborník referátů. 31. 10.–1. 11. 2005, Srní, ČZU FLE v Praze, Správa NP a CHKO Šumava.

PRETZSCH, H., 2009: Forest Dynamics, Growth and Yeld. From Measurement to Model. Springer – Verlag Berlin Heidelberg. 664 s.

PRUDIČ, Z., 1990: Areál jedle bělokoré (*Abies alba* Mill.) v Moravských Karpatech. Lesnictví. (8-9): 390–405.

QUITT, E., 1975: Klimatická oblast ČSR. Mapa 1:500000. Brno: Geografický ústav ČSAV.

SCHÜTT, P., 1994: Tannenarten Europas und Kleinasiens. Ecomed verlags – gesellschaft, Landsberg am Lech: 1–132.

SIMON, J. a kol., 1991: Zdravotní stav lesa v oblasti LZ Brumov na základě šetření na monitorovacích plochách. Závěrečná zpráva výzkumu. LDF MZLU v Brně. 260 s.

SIMON, J. a kol., 1996: Charakteristika přírodního prostředí a zdravotní stav lesa na základě šetření na monitorovacích plochách. Závěrečná zpráva výzkumu. LDF MZLU v Brně. 180 s.

ŠTEFANČÍK, I., KAMENSKÝ, M., 2009: Vývoj zalesňování zemědělských půd na Slovensku: 513–549. In: VACEK, S., SIMON, J., 2009: Zakládání a stabilizace lesních porostů na bývalých zemědělských a degradovaných půdách. Praha. Lesnická práce, s. r. o., 792 s. ISBN 978-80-87154-34-2.

VACEK, S., SIMON, J., 2009: Zakládání a stabilizace lesních porostů na bývalých zemědělských a degradovaných půdách. Praha. Lesnická práce, s.r.o., 792 s. ISBN 978-80-87154-32-2.

VOLAŘÍK, D., 2006: Stav a vývoj přirozených lesních porostů s jedlí v CHKO Bílé Karpaty. Diplomová práce. LDF MZLU v Brně. 260 s.

Address

prof. Ing. Jaroslav Simon, CSc., Ing. Zdeněk Adamec, Ústav hospodářské úpravy lesů, Mendelova univerzita v Brně, Zemědělská 3, 613 00, Brno, Česká republika, e-mail: simon@mendelu.cz, zdenek.adamec@mendelu.cz