

POTENTIAL CONSEQUENCES OF TREE SPECIES AND AGE STRUCTURE CHANGES OF FORESTS IN THE CZECH REPUBLIC – REVIEW OF FOREST INVENTORY DATA

VILÉM PODRÁZSKÝ*, DANIEL ZAHRADNÍK, JIŘÍ REMEŠ

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE, FACULTY OF FORESTRY AND WOOD SCIENCES
PRAHA, CZECH REPUBLIC

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ABSTRACT

Presented paper summarizes the generalized results of the forest inventories in the Czech Republic. It documents the dynamics of tree species composition comparing the natural, present and recommended species structure and the dynamics of the age as well as volume structure of the Czech forests. The former shift from broad-leaved and mixed forests towards to the coniferous ones in counter-balanced in the last decades, restoring more natural species composition in the region. These trends are emphasized by the example of the most important species – Norway spruce and European beech. The changes in the distribution of age classes and of the standing volume can be reflected by variable offer of the timber assortments for the wood processing industry. The turbulent environment on the timber market can be expected with hardly predictable effects on the consequent sectors, considering the Norway spruce timber. The increased amount of the broad-leaved assortments calls for utilization planning and adaptation in the wood processing, maintaining of the sufficient offer of the conifer assortment being of crucial importance as well.

KEYWORDS: Species composition, age structure, volume distribution, allowable cut, forestry sector dynamics.

INTRODUCTION

Forestry plays important role in the landscape as well as in the socio-economic space worldwide. Forests represent crucial landscape stabilizer, the most natural part of the landscapes with prevalingly natural character and with dominantly natural, spontaneous processes. They serve as a source of material as well as non-material benefits for the society in the same time, last but not least as a source of timber for mutual elaboration or for the direct use in the rural areas

(Bouriaud et al. 2013). This function (i.e. timber production) is marginalized very often in the last time. Especially the representatives of particular environmentalistic NGOs are demanding more and more area for conservation purposes, based more on ideology than good knowledge. These tendencies are very strong in the urban society without contact with the productive landscape. On the other hand, the forest ecosystems and their dynamics are very resilient as for the state and management demands (Vacek and Lepš 1987, Krejčí et al. 2013).

The aim of the presented paper is to present the supposed changes in the tree species composition, the age and spatial structure, leading potentially to the shifts in the future timber assortments composition for the wood-processing industries. The social and political context is highly exceeding the potential of the presented material on the other hand, despite of its crucial impacts.

MATERIAL AND METHODS

The presented article deals with long term development of stand areas and growing stock of main coniferous and broad leaved trees in the Czech Republic, namely Norway spruce and European beech, according to age classes. The national-level data were obtained from the forest inventories compiled by Forest Management Institute in Brandýs n. Labem, or by its predecessors. These inventories take form of Forest Inventories before 1979 (1950, 1960, 1970), Comprehensive Forest Management Plans in 1980 and 1990 and finally Information on the Status of Forests in 2000 and 2010.

The methods were described by Podrázský et al. (2013), concerning other (introduced) tree species.

From the national databases, the following characteristics were summarized:

- Stand area distribution for particular species (documented for European beech and Norway spruce) divided in 10 years age degrees (classes),
- Stand area distribution for all species, *i.e.* the age composition of all Czech forests (20 years age classes),
- Standing volume distribution for respective important species (10 years classes) and for all stands (20 years classes),
- The natural, actual and recommended species composition of the Czech forests was cited from the Annual reports of the Ministry of Agriculture of the Czech Republic (MZe 2011, 2013).

RESULTS AND DISCUSSION

The anthropogenic changes of the tree species composition are evident since millennia in many European countries, including the Czech Republic (Šálek et al. 2013). The mixed and broad-leaved forests are under strong human influences since Neolithic times, the last big trend is the large plantation (sowing) of conifer even-aged forests in the last 3 centuries, connected also with the Small Ice Age. The continuous re-introduction of the more natural species composition is visible since the WW II and it is continuing until recent time (Tab. 1, MZe 2011, 2013). In this table, the natural, actual (2010, 2012) and recommended tree species composition is documented.

In contrast to the general meaning, supported by particular “green lobby” groups, the dynamics of the Czech forests follows trends, comparable with the general European tendencies,

supposed as progressive (MZe 2011, 2013, Tab. 1). The forested area increased from 2.629 to 2.664 mil. ha between 1990 to 2010. It represents 33.78 % of the country today, compared to 20 % in the 18th century. The standing volume increased from 307 mil m³ in the year 1930 to 536 mil. m³ in 1980 and 680.6 mil. m³ today (2010). The share of the natural regeneration increased from few percent in the 1980ies to 19.0 % in 2010, its use is increasing continuously.

Tab. 1.: Historical and planned changes in the tree species composition in the Czech Republic (2010/2012).

| Species composition | Norway spruce | Silver fir | Scots pine | Eur. larch | Conifers | Oak spp. | Eur. beech | Broad-leaves |
|---------------------|---------------|------------|------------|------------|----------|----------|------------|--------------|
| Natural | 11.2 | 19.8 | 3.4 | 0.0 | 34.7 | 19.4 | 40.2 | 65.3 |
| Actual 2010 | 51.9 | 1.0 | 16.8 | 3.8 | 73.9 | 6.9 | 7.3 | 25.1 |
| 2012 | 51.4 | 1.0 | | 3.9 | 73.2 | 7.0 | 7.7 | 25.6 |
| Recommended | 36.5 | 4.4 | 16.8 | 4.5 | 64.4 | 9.0 | 18.0 | 35.6 |

The average rotation increased from 92.5 years in 1930 to 114.7 years in 2010, the total mean increment from 16.3 to 17.7 mil.m³ in the period 1990 – 2010, total current increment from 17.0 to 21.2 mil.m³ in the same time. The logging volume ranged between 14.0 – 16.7 mil. m³ simultaneously. The proportion of broad-leaved species is increasing continuously and rapidly, the contrasting situation is documented for the main coniferous species. It can be expected also profound changes in the timber species and volume, on the other side, there is expected higher stability of the forest stands and favorable changes in the soil status can be supposed too (Augusto et al. 2003).

Very similar general trends are documented by the graphical summarization and presentation of the age as well as volume distribution by age classes of all Czech forests (Fig. 1, Fig 2). Since decades, the shift towards higher age classes is clearly visible and quite regular distribution of the standing volumes as well, enabling continuous timber supply for the wood processing sector. Higher accumulation of the wood volume in the more aged forests brings the danger of less stable forest stands in the case of even-aged forestry prevailing. There is lack of comparable studies for other European countries, because of enormous time and labor expenses considered to be of less scientific relevance (e.g. Kouba 1991). But such summaries can represent very important basis for further analyses of the timber sources in our euro-region in any case, including the economical syntheses in the forestry sector (Kupčák et al. 2013).

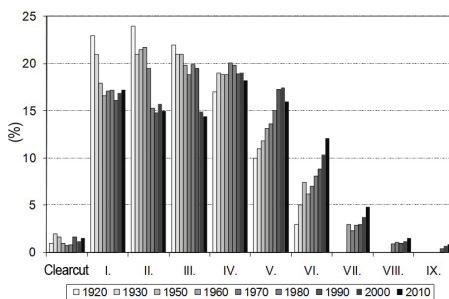


Fig. 1: Total stand areas by 20 years age classes in the Czech Republic.

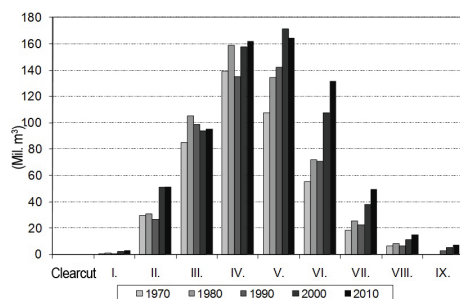


Fig. 2: Total growing stock by 20 years age classes in the Czech Republic.

The area and volume distribution of the main commercial species in our region, i.e. of European beech and Norway spruce stands, shows quite different picture (Fig. 3, Fig 4). For both species, the increase of the stand area in the highest age classes is evident, caused by the increase of the protected areas and forests. For spruce, the decrease of the planted area in the last 6 decades is significant. On the contrary, rapid increase in the beech re-introduction in the last 10 – 20 years is evident. All these trends represent the impact of forest policies during last periods. These trends indicate a possibility of the significant decrease of mature Norway spruce areas during 10 – 40 years, by cca 40 % respectively. On the contrary, sudden increase of the beech assortments offer can be expected in very close decades.

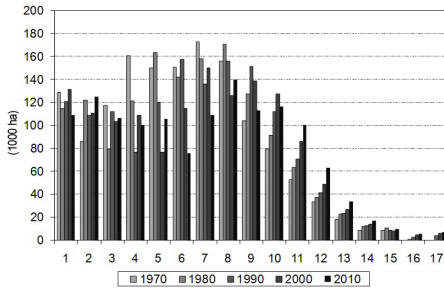


Fig. 3: Stand areas of Norway spruce by 10 years age classes.

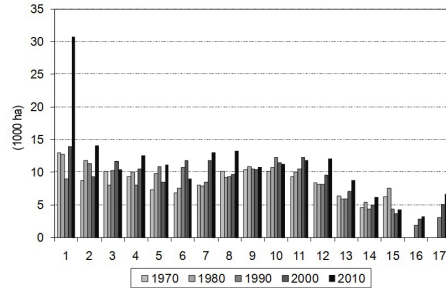


Fig. 4: Stand areas of European beech.

On the contrary, the standing volume distribution for both species does not show such a simple patterns (Fig. 5, Fig 6). For both species, the increase of standing volume in more aged stands is visible, much more for beech. This is a result of including many stands in the protected areas, beech forests being the object of protection very often (Vacek et al. 2012), as well as result of lower cutting, comparing to the increment (MZe 2011, MZe 2013). Furthermore, the increase of the standing volume in pre-mature and younger stands of the European beech (classes 4, 5, 7, 8) is evident and in the next decades the sharp increase in the youngest class can be expected (Fig. 4).

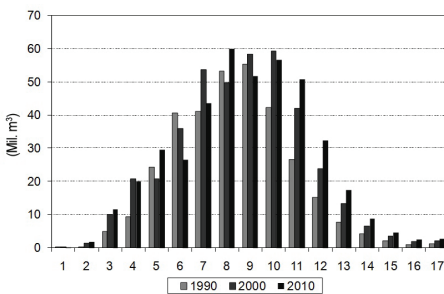


Fig. 5: Growing stock of Norway spruce by age classes.

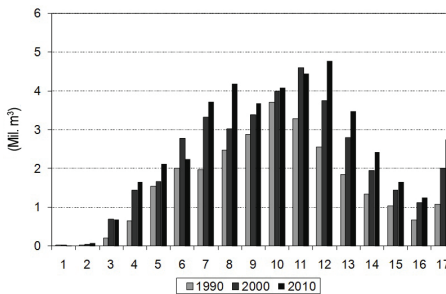


Fig. 6: Growing stock of European beech by age classes.

For spruce, the accumulation of timber volume can represent a potential danger in case of climatic and weather extremes – over-aged spruce stands being extremely labile in many locations.

On the other side, the decrease in the age classes 9, 7 and 6 can indicate potential decrease in the volume of premature age classes comparing to former periods. But considering the whole set of Norway spruce age classes, the irregularities could be balanced by proper forest management and timber market functioning.

Considering our results and other general sources, the following conclusions can be drawn up for the forestry and consequent sectors:

- the forest area, standing volume, forest production and allowable cut will increase also in the future (MZe 2011, 2013),
- the expected climatic change, despite its disputability, can result in the increase of forest production as well (Lousteau et al. 2008), with all unexpected consequences (Krejčí et al. 2013),
- the offer of coniferous (Norway spruce) timber can be stable or vary according to actual turbulences, even slight shortage can be expected in the next 2 – 3 decades,
- the offer of the timber of broad-leaves will increase, challenging the wood processing sector,
- the new sources of timber can emerge, together with cultivation of more introduced tree species as well as so called noble hardwoods, representing another challenge for wood based industry (e.g. Schmid et al. 2014), in consistence with European trends.

CONCLUSIONS

The timber market can be considered as quite turbulent in the next decades. The long term tendencies in the tree species composition as well as in the age and volume distribution can result in variable situations in the timber market. The supply of the coniferous assortment can be considerably constant, with possible variations, especially in the Norway spruce timber. On the other side, the broad-leaved species can occupy much more space in the timber market as well as in the wood processing industry. Especially European beech will represent a species with dynamics increase both in the stand area and the growing stock and wood supply as well.

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VILÉM PODRÁZSKÝ*, DANIEL ZAHRADNÍK, JIŘÍ REMEŠ
CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE
FACULTY OF FORESTRY AND WOOD SCIENCES
KAMÝČKÁ 1176
165 21 PRAHA 6 – SUCHDOL
CZECH REPUBLIC
PHONE: +420 22438 3403

*Corresponding author: podrazsky@fld.czu.cz

