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Artificial forest renewal from a forest reproductive material availability perspective

The ongoing bark-beetle calamity results in large clear-cut areas. This is followed by demanding tasks in replanting such temporarily deforested sites. New plantations, however, need a different approach including tree species share conversion. In order to succeed, it is necessary to have a whole production chain from seed zones of various species, seed-collection capacities, processing, storage and pre-germinative treatments up to forest-nursery capacities and planting operations.

The forest tree species reproductive material handling must be conducted in accordance with European prescriptions, particularly the Directive 105/ES/1999 and national legislation of the Czech Republic (CR), particularly the law 149/2003 Coll. The Forest Management Institute supervises the handling in the CR.

Sources of forest tree species seeds and planting stock

To meet the forestry practice demand for planting multi-specific forests that are expected to have an increased resilience against harmful abiotic and biotic agents, it is necessary to look for the sources, approve their sufficient number and then collect their seeds. These sources are usually forest stands, seed orchards and others. In the Report on handling with the reproductive stock of forest tree species (ÚHÚL 2021), there are listed the approved sources of totally 18 species of conifers and 57 species of broadleaves. The list includes all commercial trees such as Norway spruce, Scots pine, silver fir, both pedunculated and sessile oaks, European beech and other important accompanying species such as Douglas fir, European larch, sycamore maple, Norway maple, European ash, elms, wild cherry and also rare species needed for forest biodiversity, for example crab apple, wild pear, service tree, wild service tree and many others. The total area of the approved stand sources is 140 498.87 hectares, there are further 109 seed orchards and 22 clone mixtures and 604 other seed sources. The number of the approved sources does not change over time; the species list, however, changes towards more woody species seed source approvals.

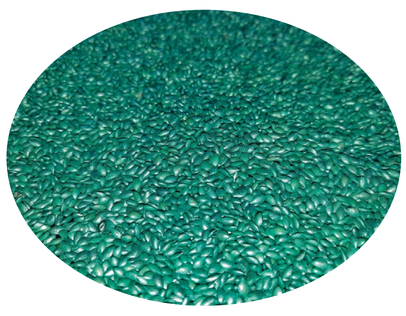
Seed collection

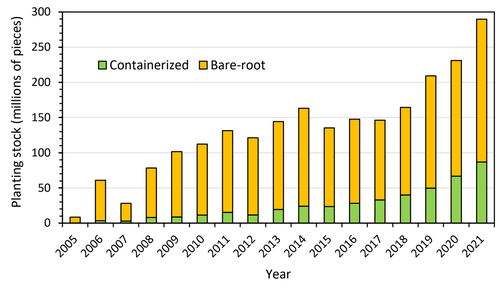
Enough seeds from approved sources for growing needed planting stock should be collected. The better seed year, the more seeds. For particular amounts of the seeds collected in the CR over the last four years see Table 1.

Table 1: Kilograms of collected seeds of commercial tree species

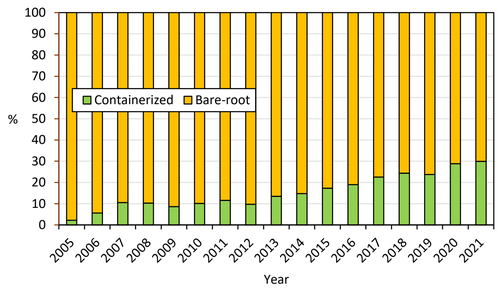
Year	2018	2019	2020	2021
Norway spruce	77 858	23 192	10 477	158 817
Scots pine	12 033	26 530	77 128	45 341
Silver fir	78 951	5 875	115 670	42 740
European beech	147 300	39 917	245 843	310
Pedunculated oak	505 067	29 086	569 816	19 650
Sessile oak	281 699	6 089	429 573	18 727

The seed collection files source is the Register of certified origin, which is available online on the website http://eagri.cz/public/app/uhul/ERMA2. As for the conifers, amounts of the collected cones are reported. As for the broadleaves, amounts of collected seeds, fruits or infructescenses are reported.





Graph 1: The amounts of the planting stock (containerized and bare-root) shipped from nurseries in particular years (based on ERMA2 reports)



Graph 2: Share of the shipped containerized (black) and bare-root (grey) plants in particular years [%]

Seeds processing

The collected seed stock is usually processed and stored at the Seed plant of the Forests of the Czech Republic, state-owned company located in Týniště nad Orlicí. Then the seeds are shipped to forest nursery practitioners; if needed, the pre-germinative treatment is also conducted. Over the last years, amounts of the seeds from broadleaves have increased, which also raises the issue of additional treatments, both short-term and long-term storage, are conducted. It is necessary to avoid technological mishaps. Besides, the broadleaves need the larger air-conditioned storage capacity compared to conifers. The Seed plant can ship the seed's amounts that allow to grow 100 million up to more than 200 million plants of all woody species used in forestry every year. The Seed plant is equipped with new technologies and its capacities are enlarged due to the great demand on seeds.

Forest nurseries

Together with increasing amounts of the seeds collected, processed and stored, forest-nursery areas grow and technologies are modernized. The share of containerized planting stock has also increased, which means 15.91% in forest nurseries, and even higher share of all merchantable plants (29.9%) has been shipped. The forest-nursery capacities seem to be satisfactory and the planting-stock market seems to be saturated. Some failures happen due to weak seed years of certain tree species. Annual planting stock shipping has increased from pre-calamity mean values of 139 million plants to almost 290 million plants at present (Graph 1). The amounts of both containerized and bare-root plants shipped in particular years are presented in absolute figures (Graph 1) and also as percentage (Graph 2).

The renewal rules

The reproductive material shipping is conducted according to reproductive material law, and artificial planting is legally regulated by forestry law. To succeed in planting large calamity plots as fast as possible, a common measure relaxing the rules was issued by Ministry of Agriculture. At present, forest owners are more free to do what they want with their property, however, more responsibility is passed to them to plant, establish and grow forests providing society with all needed services.