**Large-scale production of containerized forest seedlings in Sweden as an example of nursery production in the boreal conifer regions**

* **state-of-the-art and technology transfer based on the Zephyr concept**

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**Abstract**

The boreal forest stretches over the northern hemisphere in a large circumpolar band across Scandinavia, Canada, Alaska and Russia and include about one-third of the world´s forested land.

In Sweden the production volume of forest seedlings corresponded in 2014 to 370 million and of these almost 90% were container seedlings. Regarding species Norway spruce and Scots pine totally dominates the production and accounts for more than 95%.

Regarding state-of-the-art container stock is kept in plastic greenhouses at a density ranging from 400-800 seedlings/m² during germination and early growth where cultivation normally can start in April and continue to August. After the greenhouse phase, that covers about 2 months, the seedlings are moved to outdoor areas for completion of growth and hardening off. When the seedlings are frost tolerant they are planted out in the field or cold stored during winter in storage facilities at -4°C before planting out during next year.

The technology transfer based on the Zephyr concept has started to be introduced in cultivation of containerized forest seedlings in Sweden. The Zephyr concept includes pre-cultivation at high density (3500 seedlings/m²) in an environmental friendly and cost efficient growth chamber not affected by outdoor climate making it possible for a year-around production. This production includes direct transplanting to outdoor conditions after pre-cultivation during the vegetation period. When outdoor climate conditions do not allow this, an intermediate period of cold storage is introduced before transplanting to outdoor conditions during next vegetation period.

The Zephyr concept offers many advantages compared to state-of-the-art. Among these the following can be mentioned:

* significant reduction in energy consumption and related costs when going from heating by fossil fuels to alternative energy sources
* zero-impact of greenhouse gas emissions by not using fossil fuels for heating during germination and early growth
* significant reduction in leakage of nutrients and pesticides by zero-impact technology during the pre-cultivation phase
* significant reduction in water consumption by recycling during the pre-cultivation phase
* technology transfer from forest to agricultural-food plant indoor cultivation