12 YEARS EXPERIENCE
WITH HYBRID ASPEN
SHORT ROTATION
IN ESTONIA

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About Forestry in Estonia

- **50.6%** of Estonian territory is covered by forests
- Area of forestland 2 212 000 ha
- Growing stock 458 448 000 m³
- Annual increment 5.8 m³/ha
- Main tree species: Scots pine (**Pinus sylvestris**) 33.6%, Norway spruce (**Picea abies**) 16.7%, Birch (**Betula pendula, B. pubescens**) 30.8%
- Most of the forests are natural or semi-natural
- Most of the energy wood resources come from low quality timber from forests and timber processing residues
- During the last years plantation forestry has spread in Estonia
Short Rotation Forestry (SRF) in hemiboreal conditions

- Area of forest plantations is increasing globally, according to FAO about 7% of all world forests are planted. In Nordic and Baltic countries, where forestry has traditionally been oriented to long rotation periods (commonly 50 to 120 years), short-rotation plantation forestry (SRF) with rotation periods < 30 years is a new silvicultural concept.

- The goal of SRF is to achieve maximum biomass production and to harvest the stand when mean annual increment reaches its highest value.

- There are several important reasons why SRF has received more attention in Northern Europe during the last three decades.
  - Due to political, economic and social changes, agricultural land use has decreased and forest area has increased in several countries in the region. Establishment of SRF plantations is one alternative land use for abandoned agricultural lands.
  - Member states of the European Union have to follow EU energy policy and raise the share of energy from renewable sources to 20% by 2020 (DIRECTIVE 2009/28/EC); woody biomass from SRF plantations is an option for reaching that goal. A suitable tree species for SRF in a boreal climate are poplars, aspens, alders, birches and willows
  - Establishment of SRF stands with deciduous tree species could be one alternative land use for abandoned agricultural areas in hemiboreal conditions and one opportunity to protect natural forests, which have high biodiversity value.
Our focus on SFR in Estonia:

Silver birch
(Betula pendula Roth.)

and

Hybrid aspen
(Populus tremula L. x P. tremuloides Michx.)
A hybrid between *Populus tremula* L. and *P. tremuloides* Michx., known as hybrid aspen, has proved to be one of the fastest growing deciduous trees in the region.

- Managed in 25-yr rotations for the combined production of pulpwood, energy wood and aspen logs.

In Estonia more than 700 ha of hybrid aspen plantations have been established since 1999, mostly on abandoned agricultural lands, but also for the reclamation of an exhausted oil shale quarry.

- Breeding programmes have resulted in clones with **MAI reaching 20–25m³ ha⁻¹ yr⁻¹** during 20- to 30-yr rotations and **CAI** have reached to **36m³ ha⁻¹ yr⁻¹** on 13th growing season

- During recent decades about **4500 ha** has been cultivated with hybrid aspen in **Northern Europe** both for experimental and practical purposes
Hybrid aspen: topics and key words:

- Silver birch, grey alder and hybrid aspen plantations in hemi-boreal conditions
- Biomass production and nutrient cycling in deciduous plantations in (Estonia or Baltic region or hemi-boreal conditions).
- Growth dynamics of deciduous trees under changing climatic conditions
- Biodiversity
INTRODUCTION: research needs

- Growth and site preferences of silver birch, grey alder and hybrid aspen have mainly been studied in small-scale experimental plantations, knowledge from large-scale commercial plantations is scanty.
  - The growth development of plantations has previously not been evaluated in Estonia.
- It is difficult to predict how former agricultural soils will meet the site requirements of nutrient and water demanding aspens.
  - The physico-chemical properties of field soils are somewhat different from the equivalent forest soils. Cultivation creates a sharp plough layer boundary between the top- and subsoil, decreases organic matter content and degrades soil structure, and some compaction problems can even occur on fields. Fertilization has improved nutritional status of naturally nutrient-poor soils.
International contacts:

- Johann Heinrich von Thünen Institute (Germany), Georg Wühlisch
- Forest Research Institute of Sweden (Skogforsk), L. Rytter, L.-G. Stener
- SLU, M. Weih
- Finnish Forest Research Institute (Metla), P. Pulkkinen, L. Suvanto
- Latvian State Forest Research Institute (Silava), M. Zeps, A. Gailis
- Latvian State Forest’s Stock Company (LVM Seeds and Plants), G. Grandans
- private company NextForest AB (Sweden) SÖDRA (Sweden)
○ Hybrid aspen plantation
○ Silver birch plantation

Fig. 1. Locations of the experimental areas
Figure 4. Height development of young fast-growing deciduous stands with hybrid aspen (1Rytter and Stener, 2005; 2Johnsson, 1976; 3Hynynen and Karlsson, 2002), Alnus incana (4Uri et al., 2009), Betula pendula (5Jänes, 2009; 6Krigul, 1971) and Populus tremula (6Krigul, 1971)
Height development of common aspen (*Populus tremula*) and hybrid aspen (*P. tremula* x *P. tremuloides*) stands in Estonia. Error bars show the range of plantation means.
Distribution of trees according to height and DBH in 12- to 13 yr-old hybrid aspen (*Populus tremula* x *P. tremuloides*) and silver birch (*Betula pendula*) plantations. Class upper boundaries are shown on the x-axis.
Comparison of above-ground biomasses in 2-yr-old stands of regenerating hybrid aspen (author’s study), fertilized and unfertilized willows (Heinsoo et al., 2002) and grey alder (Uri, 2000) in Estonia.
Free air humidity manipulation (FAHM) in a deciduous tree canopy

Experimental set-up and some preliminary results

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Introduction

- Water vapour is a substantial greenhouse gas and its concentration in the atmosphere is rising due to global warming.

- Air humidity is a factor of great importance for plants.

- Little is known about effects of air humidity and precipitation on trees and forest functioning.

- FAHM facility is designed to study interactions between water, carbon and nutrient cycling processes during tree canopy formation of deciduous forest stand.
FAHM experimental site
(established 2006/2007)

Rõka village
Järvselja Experimental Forest District
South-Eastern Estonia
58°24’N 27°29’E

9 experimental plots (14×14 m)
3 misting plots
3 control plots
3 open-top plots
(drying, humidification, control)
RESULTS during last years

- 12 Publications in ISI Web of Science database during last 5 years
- 1 + 1 PhD degrees
- 5 master thesis
- EFINORD project
Conclusions

• The study confirmed that hybrid aspen stands, both planted and naturally regenerated, can be highly productive in hemiboreal climate at fertile sites on abandoned agricultural lands.

• The biomass of 2-yr-old hybrid aspen sucker stand was comparable to that reported for willows of the same age showing the high potential of regenerating hybrid aspen for energy wood production.

• If high demand and price of energy wood persists then hybrid aspen plantations can be successfully managed in rotations shorter than 25 years for the production of energy wood.
Thank you!