

Provenance differences in above-ground biomass of *Pinus* contorta Dougl. var latifolia Engelm. and *Pinus sylvestris* L.

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Introduction

Increasing demand for wood as a renewable resource in past decade in Latvia and Globally ensures a importance to study different options to increase wood production. One of them being – to establish plantation of high-yielding species and provenances.

Mostly recommended options for establishment of biomass plantations – hybrid aspen and other *Populus* or *Salix* clones – are not suitable for all soils and conditions, therefore also other options needs to be considered.

Recent analysis of *Pinus contorta* provenance trials in Latvia suggests, that this species have lower branch quality than *Pinus sylvestris*, but presumably higher biomass. Aim of this study was to calculate above-ground biomass of *Pinus contorata* based on empirical data and estimate its potential in comparison to *Pinus sylvestris*.

Test site

Study is based on results from experiment, established in central part of Latvia, that consists of 15 open-pollinated families of *Pinus contorta* from 3 provenances and one open-pollinated *Pinus sylvestris* control lot. Trees are located in *Vacciniosa* forest type in 4 replication, using 60 tree block plots. Initial spacing 1x2m, no thinning carried our prior to measurements at the age of 26 years. Trial is affected by root rot and animal damages.

Aboveground biomass (stem, green branches, dead branches) was measured during January and February, 2010 (fig.1), for 323 trees that does not have notable damages, double leader or large spike knots.

Results and conclusions

Analysis indicate, that on average 73% of total tree naturally moist above-ground biomass is in stem, 7% - in dead branches and 20% - in green branches and needles. This relationship was is similar for both species even if earlier study found notably higher number of branches per meter for *Pinus contorta*.

Correlation analysis reveal, that stem biomass is related almost equally with tree height and diameter (r=0.80 and r=0.88 respectively), but branch biomass (especially for dead branches) is tightly related just with tree diameter (r=0.76) and less with tree height (r=0.53).

Relationship among tree diameter and components of above ground biomass (fig.2) was used to calculate the total naturally moist aboveground biomass per ha in real conditions and potential (fig.3), assuming no root-rot influence (average survival 68%).

Results reveal up to two-fold differences in total above-ground biomass among *Pinus contorta* families indicating the importance of selection of appropriate plant material for establishment of biomass plantation. Based on sample analysis it was estimated, that average relative moisture of the material is 57%. Considering that, biomass production capacity of *Pinus contorta* on average is $3.5t_{dry}$ ha⁻¹y⁻¹. That is notably lower than the figures mentioned for hybrid aspen or Salix clones, but almost 2.5 times higher than for *Pinus sylvestris*.

Even higher biomass could be obtained, if the plantations would not be affected by root rot (potentially on average $4.0t_{dry}\,ha^{-1}y^{-1})$.

Further studies, considering the differences in moisture content in different height of stem and branches as well as fact, that high proportion of trees (on average 55%) have double leaders or large spike knots, would improve the accuracy of presented estimates.



Figure 1. Weighting of stem biomass in Pinus contorta experiment



Figure 2. Weight of components of above-ground biomass in relation to tree diameter for *Pinus contorta* at the age of 26 years



P.sylv. – Pinus sylvestris

Figure 3. Observed and potential (assuming no mortality from root rot) naturally moist biomass of *Pinus contorta* and *Pinus sylvestris* at the age of 26 years