

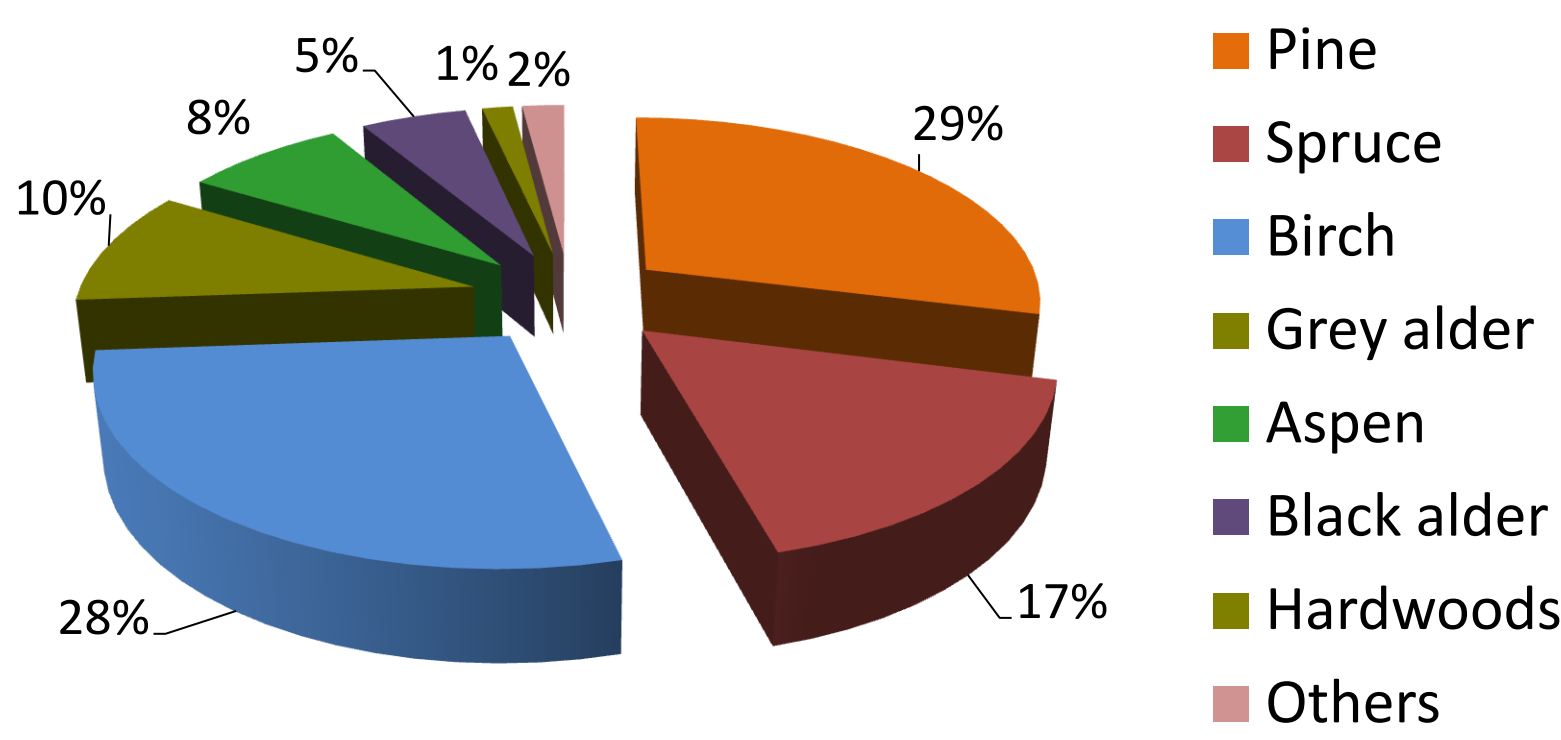
GROWTH DYNAMICS OF PLANTED EVEN-AGED NORWAY SPRUCE STANDS IN LATVIA

Zane Libiete-Zalite, Toms Zalitis, Aigars Indriksons, Latvian State Forest Research Institute “Silava”,
Rigas Str. 111, Salaspils, LV-2169, Latvia, zane.libiete@silava.lv

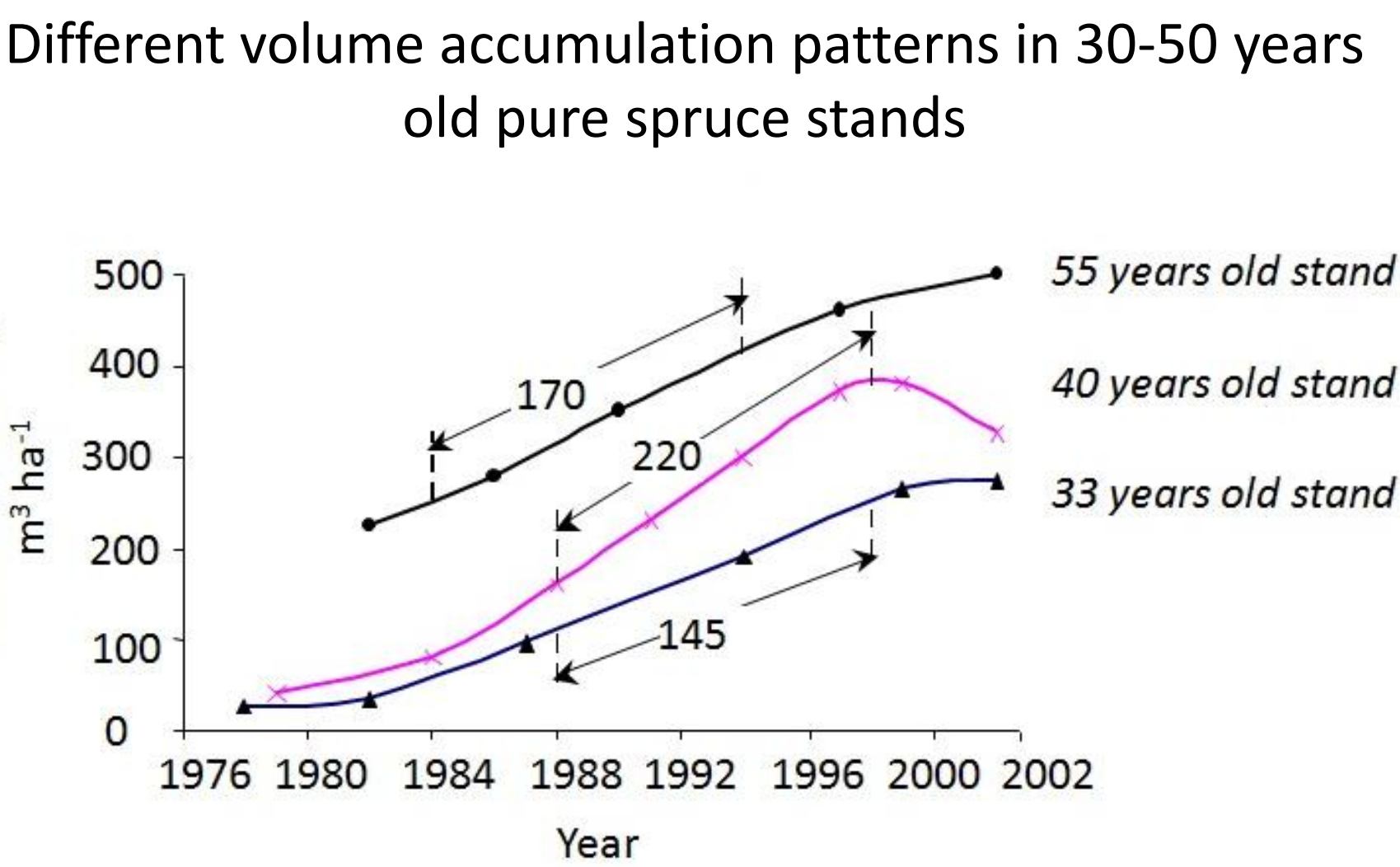
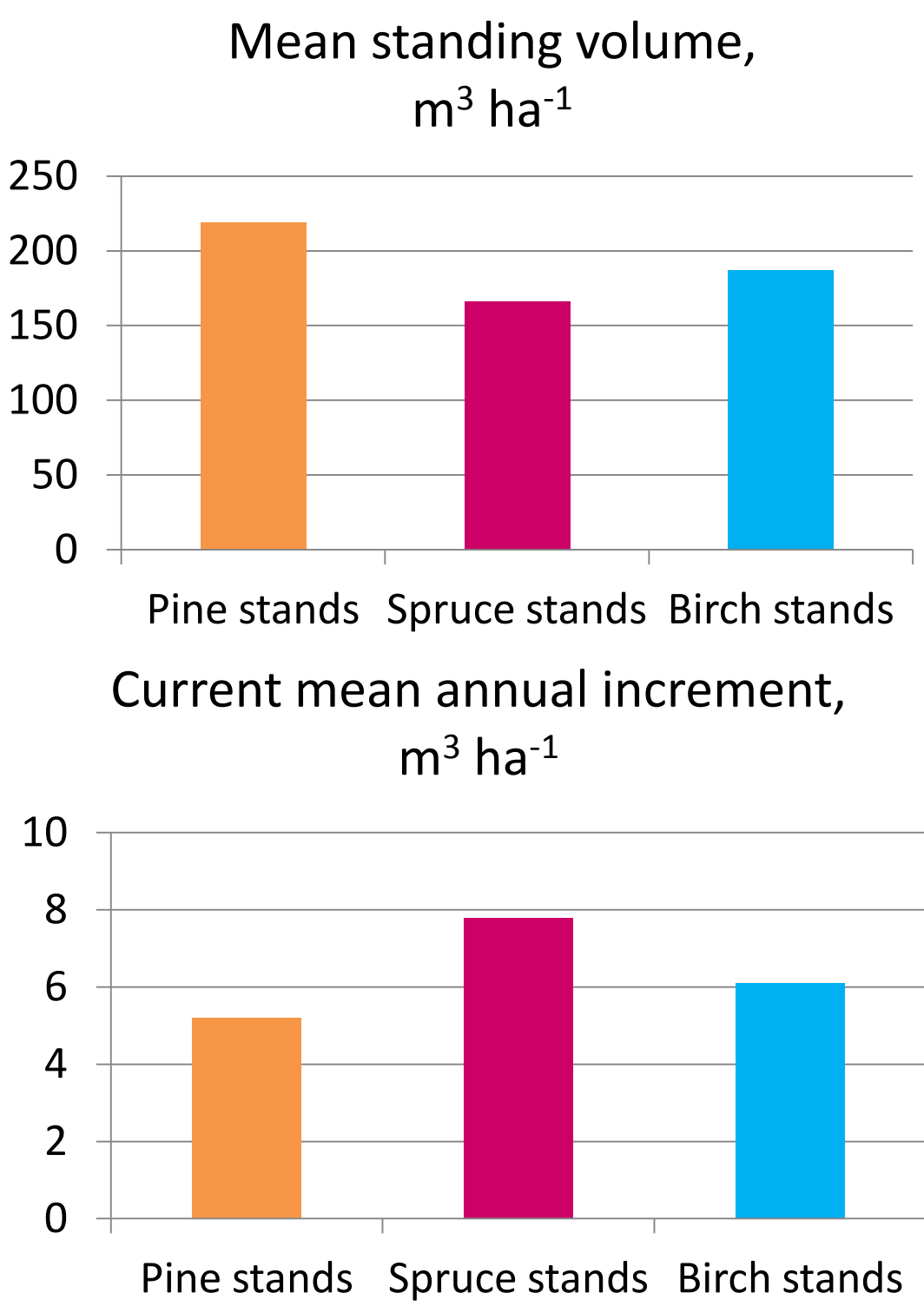
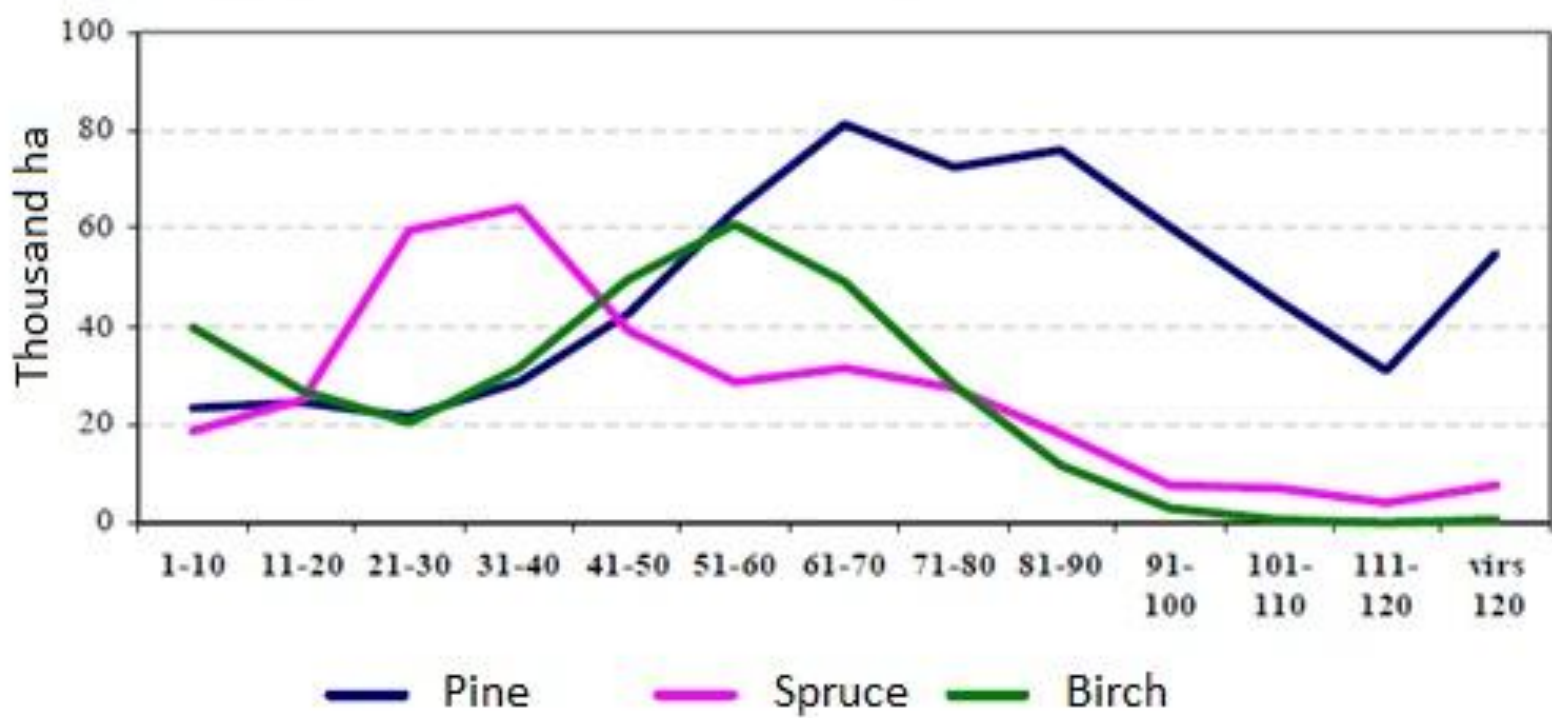


Present situation. Norway spruce (*Picea abies* (L.) Karst.) is the third most widespread tree species in Latvia. Stands dominated by spruce take up 17% of the total forest area. Almost one half (48%) of all spruce-dominated stands are located in dry mineral soils, 11% in wet mineral soils, 2% in wet peat soils, 26% in drained mineral soils and 13% - in drained peat soils. The age structure of spruce forests is uneven, 20-40 years old stands taking up the largest share.

Forest area according to the dominant tree species, all forests (NFI data, 2009)



Age structure of the main tree species in state forests (NFI data, 2009)



Problem. Presently existing 30-40 years old spruce stands have mainly originated from even-aged plantations established in the second half of 20th century for pulpwood production with increased initial number of trees (even 5000 to 7000 trees per ha⁻¹). However, due to the collapse of the pulpwood industry, the planned intensive management and early final felling at the age of 40 was not carried out in these overstocked plantations. These stands were left for conventional management and regular rotation (80 years for Norway spruce in Latvia). Young spruce forests are, as a rule, highly productive. Current annual increment in 20-30 year old stands can be as high as 20 m³ ha⁻¹ a year. However, in some of these initially high-yielding stands sharp decrease in productivity and even stand collapse can often be observed.

Aim of the research. Impact of different factors on growth potential and productivity of even-aged young Norway spruce stands in fertile site types was studied. High growth potential means capacity of the stand to retain high productivity and ensure intense volume accumulation. Low growth potential is characteristic to stands where volume accumulation has sharply decreased and volume accumulation rate has approached zero or become negative.

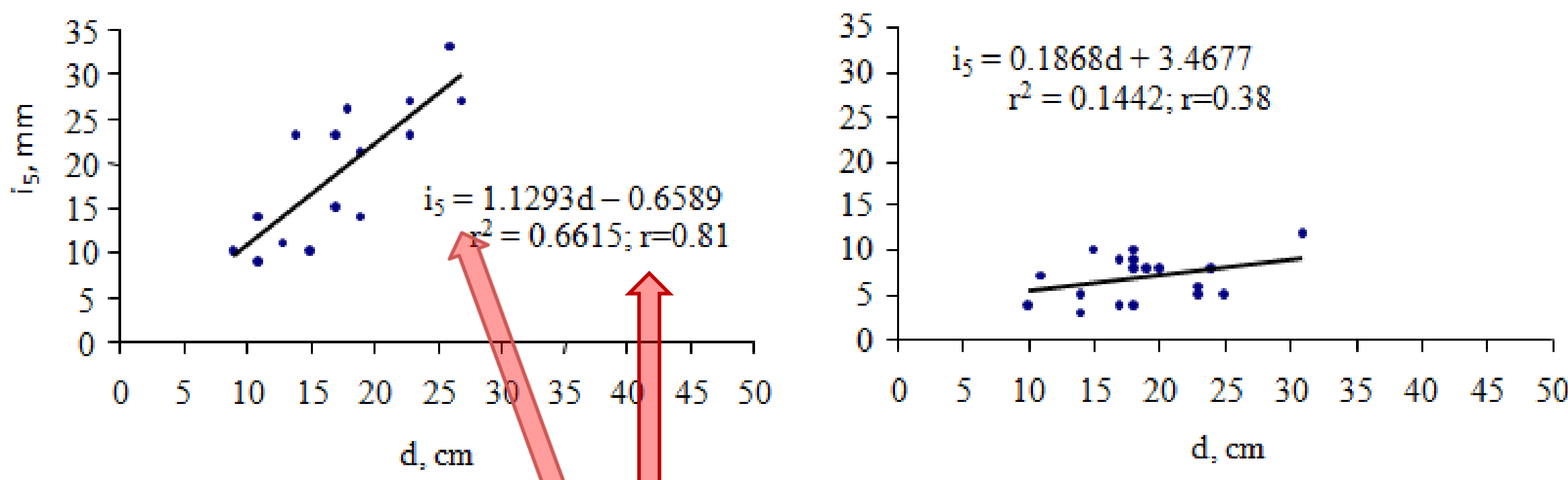
Study material. Growth data from 40 long-term sample plots (re-measured 3-9 times), information about spruce radial growth from 405 stands in state forests and 25 stands in private forests (width of last 10 annual rings from a representative biogroup of 20 trees from each stand), NFI data about 449 pure spruce stands and 280 mixed spruce stands.

Methodology. Three growth potential groups were identified for 30-50 years old pure spruce stands: 1) perspective stands; 2) increased risk stands; 3) non-perspective stands. Group indicators originate from linear relationship between DBH and width of last 5 annual rings:

$$i_5 = a \cdot d + b, \text{ where}$$

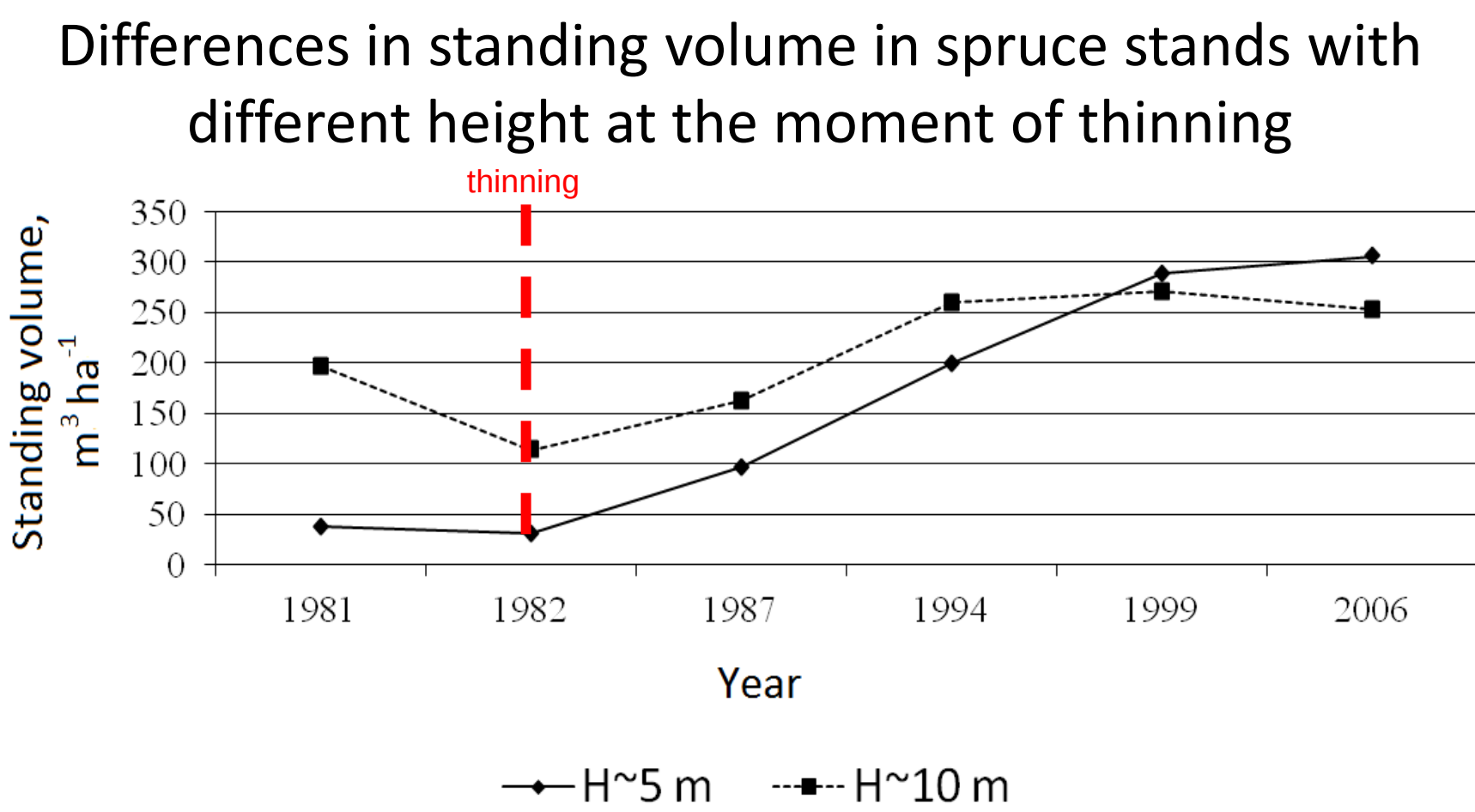
i_5 – total width of last 5 annual rings, mm
 a, b – regression coefficients
 d – DBH, cm

Relation between DBH and the total width of last 5 annual rings in a perspective (left) and non-perspective (right) pure spruce stand

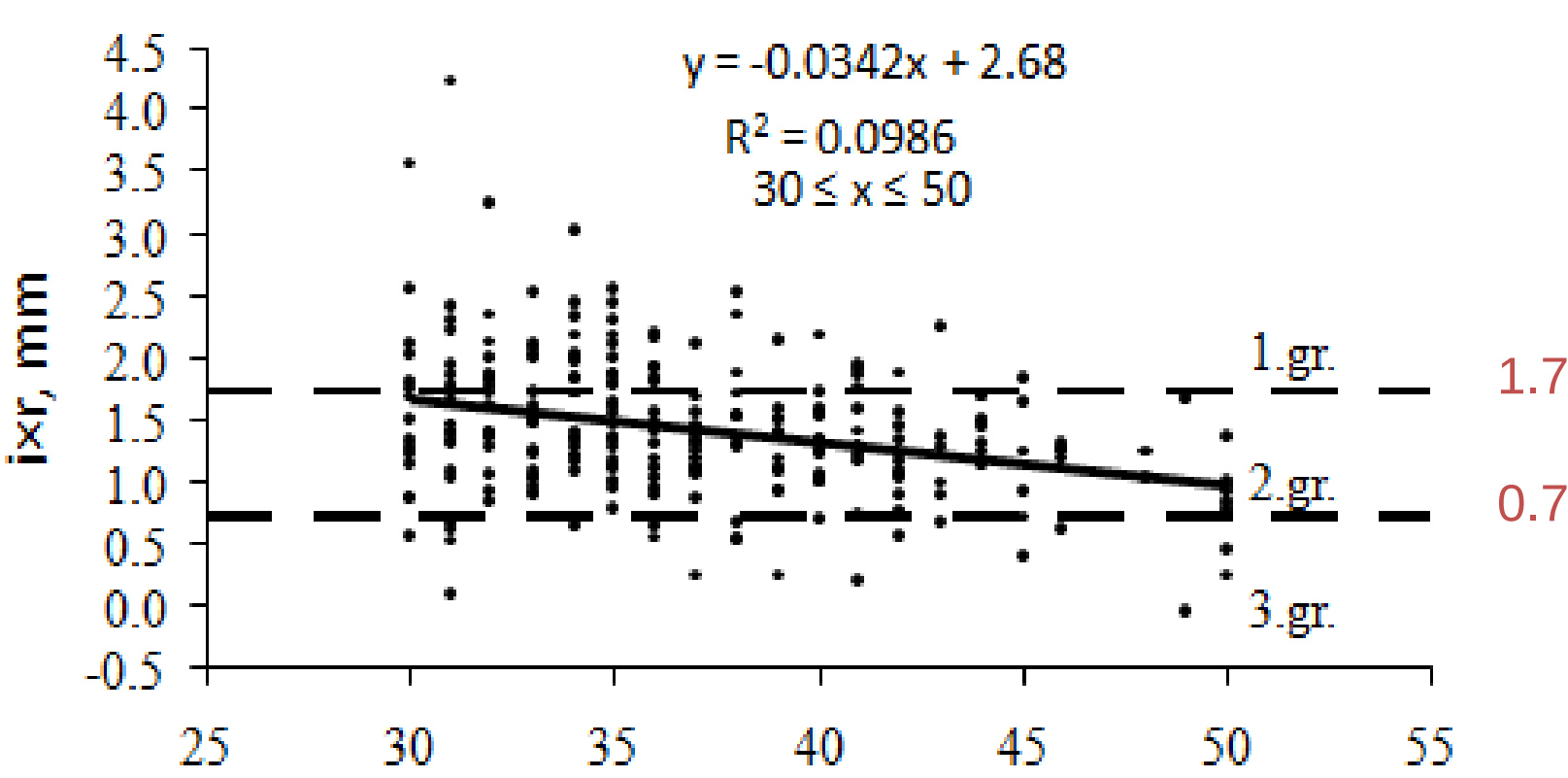


Group indicator $i \cdot r$ was further used for mathematical processing of the data ($i = i_5/5$). In non-perspective stands, $i \cdot r < 0.7$, in perspective stands, $i \cdot r > 1.7$.

Main results. 1. At present there are three types of spruce stands in Latvia, different in origin and growth features: pre-mature and mature uneven-aged stands established naturally from under-storey; young and middle-aged spruce monocultures established by planting more than 2 500 trees per ha, including considerably overstocked stands where proper pre-commercial thinning has not been carried out; sparse young stands that are established according to current recommendations (less than 2 500 trees per ha).
2. In stands that are thinned to 2000 trees per ha before their mean height exceeds 5 m, growth rate increase is much more pronounced than in stands that are 10 m tall at the moment of thinning.
3. In initially overstocked young spruce monocultures where the stand volume has reached 250-300 m³ ha⁻¹, often a sharp decrease of stand productivity and growth potential can be observed.



Relation of the growth potential of pure spruce stands with the stand age



Differences of the growth potential of pure spruce stands in different growing conditions

