INVESTMENT IN YOUR FUTURE

Funded by the European Union

Climate impacts on lodgepole pine (*Pinus contorta* var. *latifolia*) height growth in a provenance experiment- some preliminary results

Zane Libiete-Zalite, LSFRI “Silava”

Some theoretical background (1)

- Lodgpole pine (*Pinus contorta*, including all subspecies) is widely spread throughout western North America, growing between the latitudes 30° and 64°N.
- Lodgepole pine has a wide ecological amplitude, its varieties being adapted to maritime, continental and subalpine conditions and capable of growing on any type of site.
- There are three main varieties: a coastal form (var. *contorta*), a southern inland form (var. *murrayana*) and a northern inland form (var. *latifolia*).
- The *latifolia* variety has proved useful in northern European conditions, combining fast and straight growth with sufficient climatic hardiness; around 1970 large-scale introduction of these species was started in Sweden.

Some theoretical background (2)

According to results of Scandinavian experiments,

- The wood quality of lodgepole pine is comparable to that of Scots pine (*Pinus sylvestris* L.)grown under similar conditions;
- Lodgepole pine has slightly lower wood density, lower bark proportion in stem volume, higher proportion of heartwood and better stem form than Scots pine;
- Lodgepole pine is estimated to produce up to 36% more yield than Scots pine, irrespective of the site index; the optimum rotation is 10-15 years shorter;
- Survival during the initial stand development is higher for lodgepole pine than for Scots pine;
- Lodgepole pine plantations are less stable and lose more biomass due to wind and snow damage than Scots pine.

Consequently...

- Lodgepole pine might be of interest for production of energy wood, pulpwood and perhaps also saw-timber in plantation forestry in Latvia

Understanding tree growth-climate relationships

- Before any recommendations for the use of lodgepole pine in Latvian forestry can be made, it is essential to understand how the tree growth is affected by weather and climate variables in Latvian conditions ➔ ADAPTATION
- The most common way to analyze responsiveness of the growth to the climate variables is the analysis of radial growth patterns (tree-rings)
- Several studies suggest that height growth is more suitable for examining the effects of climatic variations, less frequent use of this variable is most likely associated with more laborious gathering of the data

Objective

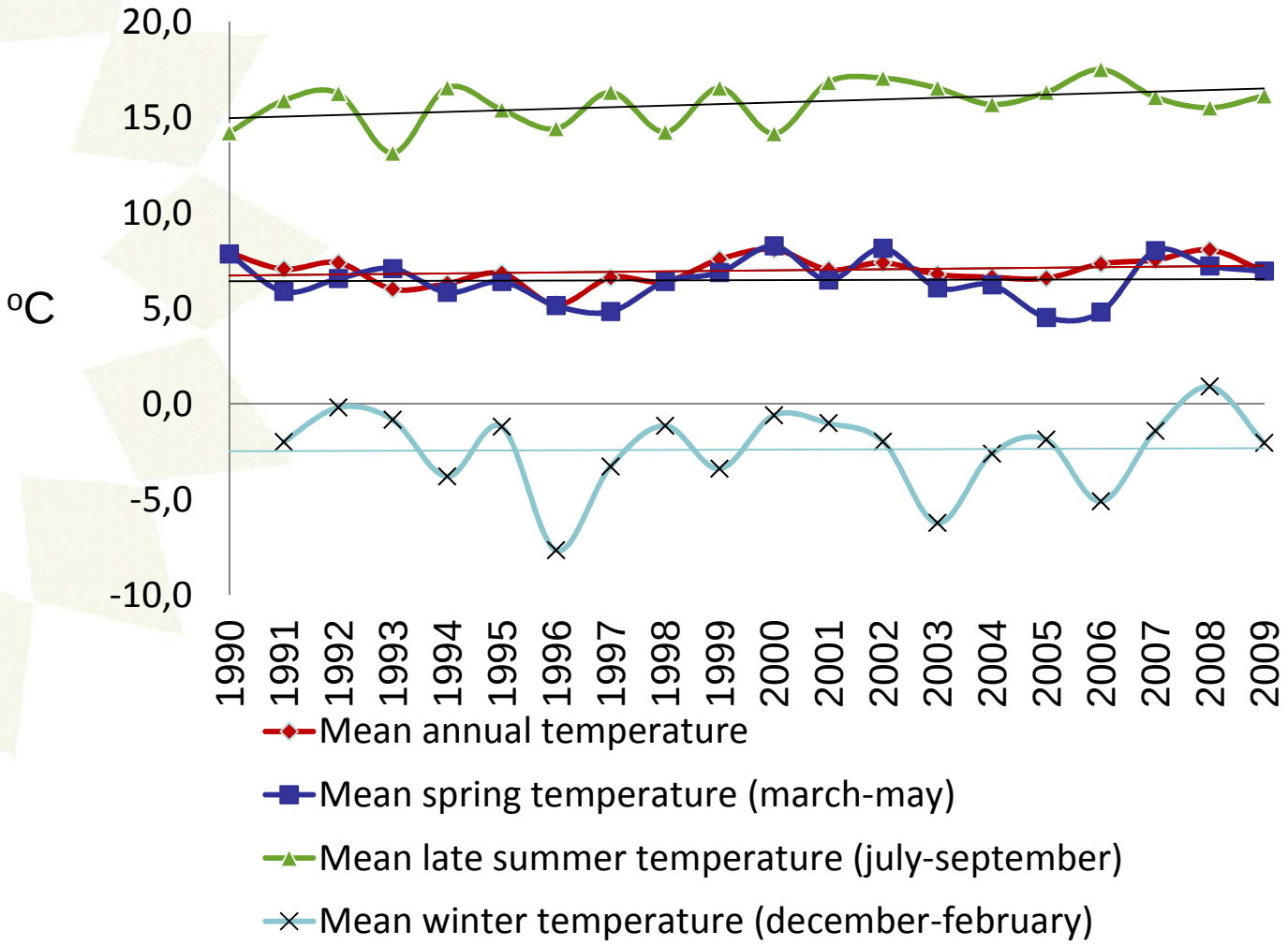
- The objective of the study was to analyze the effects of climate variables (temperature, precipitation) on the height growth of lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) trees from three various provenances

Study material

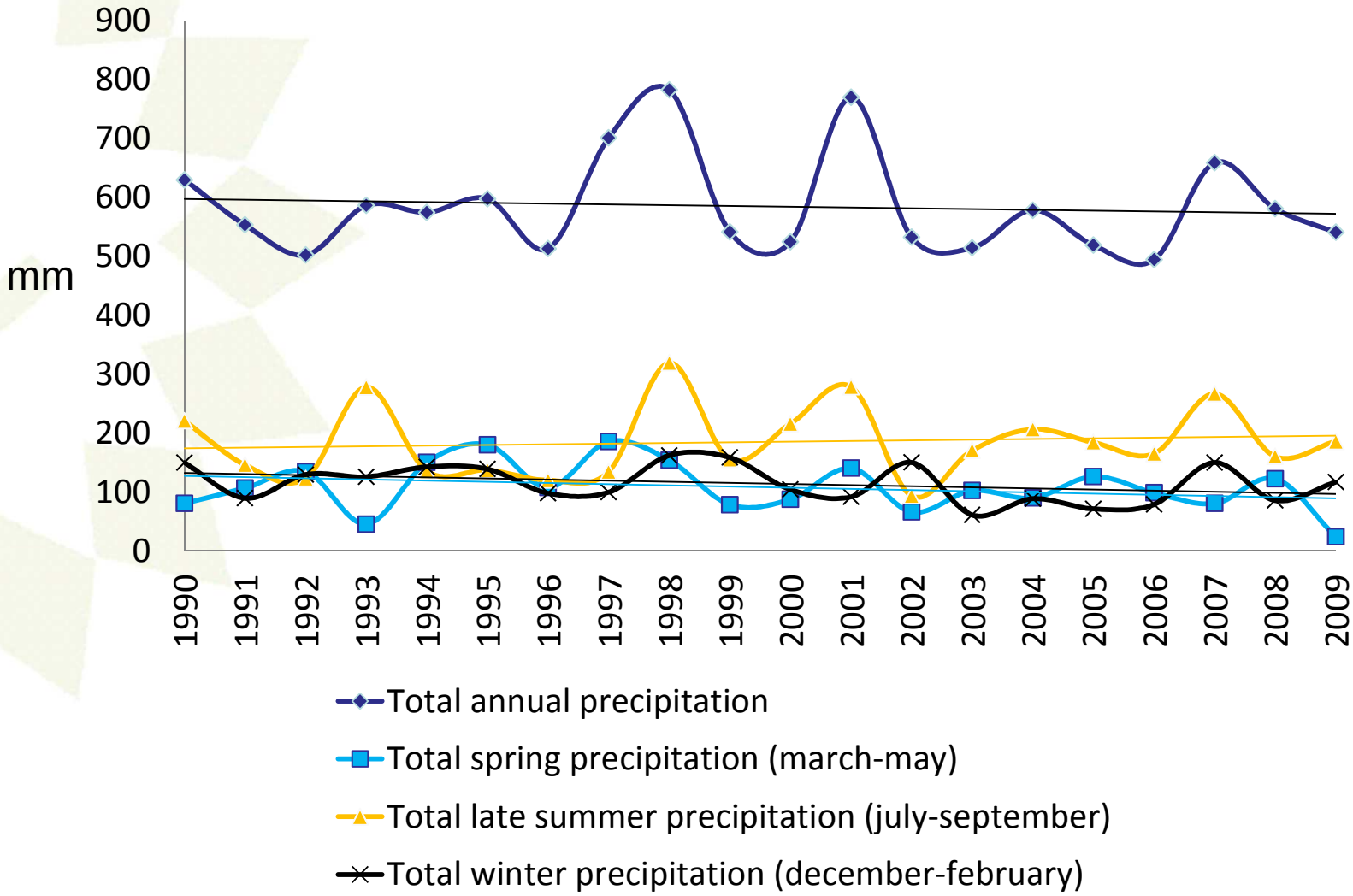
- Information on annual height growth (cm) of 297 lodgepole pine trees of 3 proveniences – Pink Mountain, Fort Nelson, Summit Lake
- Location of plantation – Zvirgzde
- Year of plantation establishment – 1985
- Information about mean monthly temperature and monthly precipitation amounts from meteostation Bauska

Provenance	Geographical		
	latitude	longitude	altitude a.s.l.
Pink Mountain	57°00'	122°15'-45'	850
Fort Nelson	58°38'	122°41'	495
Summit Lake	54°24'	122°37'	813

Temperature change



Precipitation change



Climate variables

Temperature variables

- Mean annual temperature
- Mean annual temperature of the previous year
- Mean late summer temperature of the previous year (July-September)
- Mean temperature from previous October to April of the current growing season
- Mean temperature of previous November-December

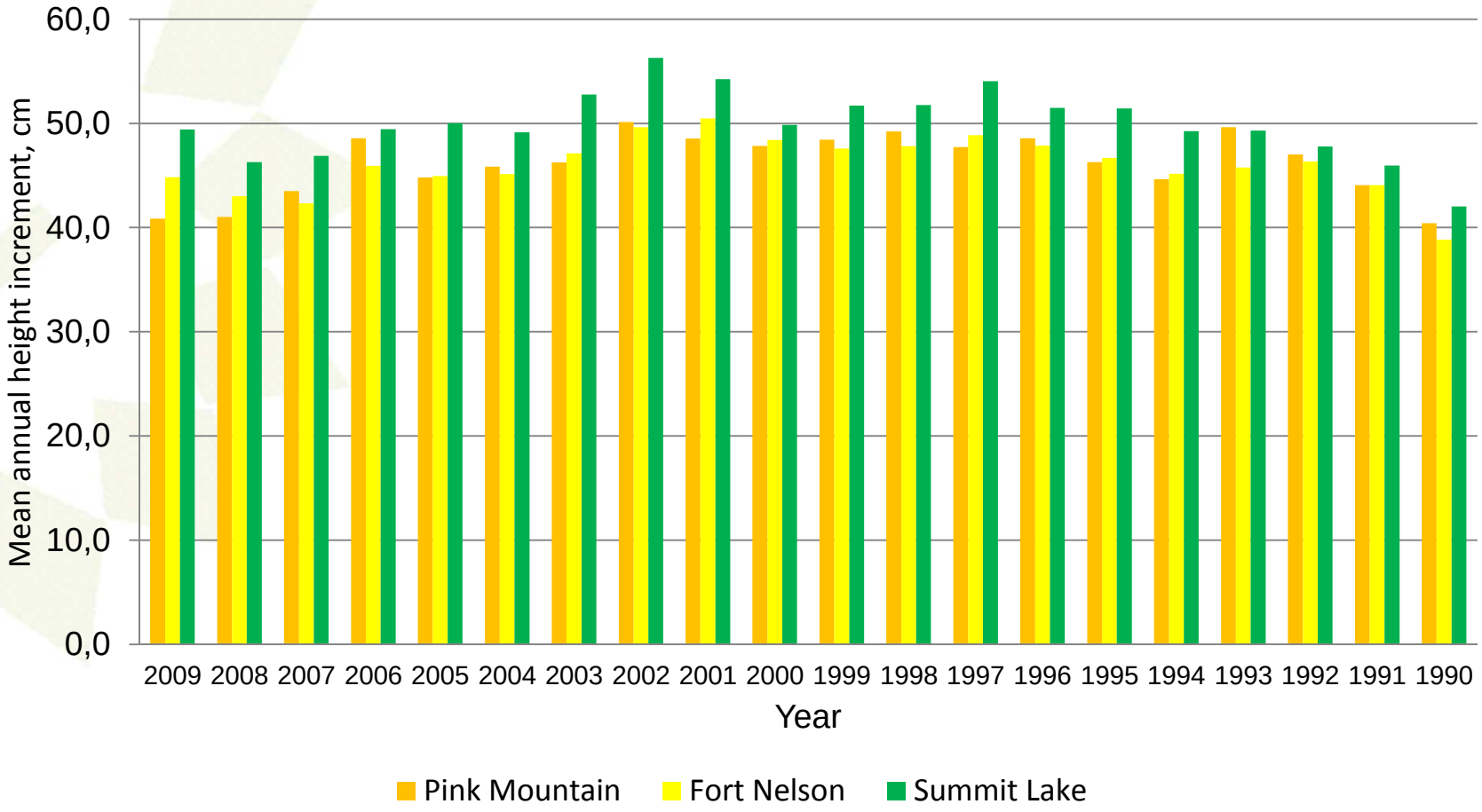
Precipitation variables

- Total annual precipitatipon
- Total annual precipitation of the previous year
- Total precipitation from previous October to April of the current growing season
- Total late summer precipitation of the previous year (July-September)
- Total precipitation from previous December to February
- Sum of total precipitation of previous and current growing season (May-August)

Analysis

- All tree height increment values prior to 1990 were excluded from the analysis to remove establishment-related growth effect
- Linear regression analysis was used to determine possible relationships between annual height growth and climate variables
- Analysis was performed separately for each provenance

Results – mean annual height increment



Results – correlation with climate variables – Pink Mountain

Climate variable	R	R^2	F	p
Mean t°	0.078	0.006	11.264	0.001
Mean t° of the previous year	0.087	0.008	13.912	0.000
Mean late summer (July, August, September) t° of the previous year	0.018	0.000	0.606	0.436
Mean t° from previous October to April	0.080	0.006	11.702	0.001
Mean t° of previous November and December	0.069	0.005	8.603	0.003
Total annual precipitation	0.015	0.000	0.420	0.517
Total annual precipitation of the previous year	0.011	0.000	0.235	0.628
Total precipitation from previous October to April	0.017	0.000	0.528	0.467
Total late summer (July, August, September) precipitation of the previous year	0.015	0.000	0.398	0.528
Total precipitation from previous December to February	0.016	0.000	0.459	0.498
Total precipitation of the previous and current growing seasons combined (May-August)	0.060	0.004	6.635	0.010

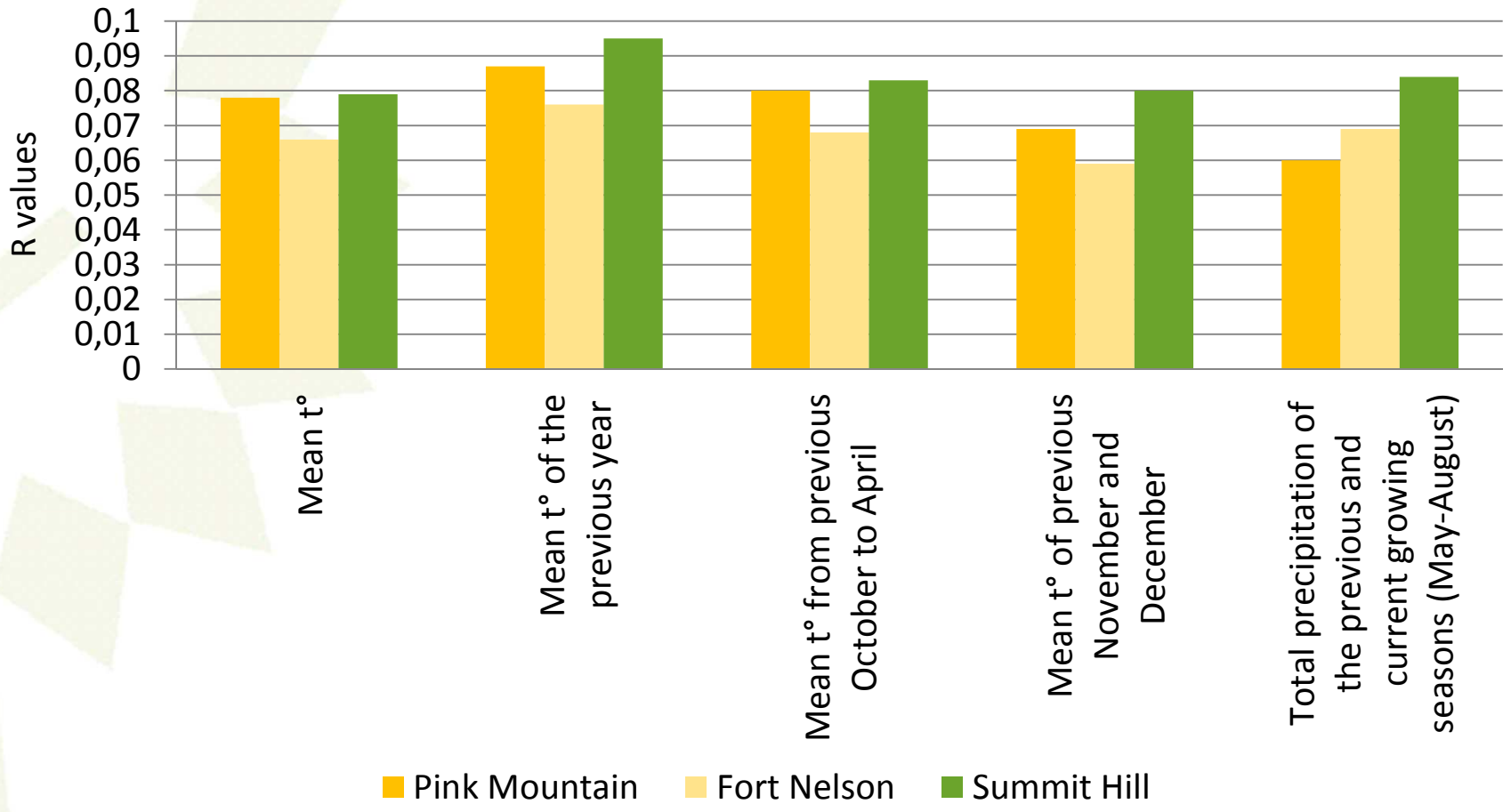
Results – correlation with climate variables – Fort Nelson

Climate variable	R	R^2	F	p
Mean t°	0.066	0.004	8.943	0.003
Mean t° of the previous year	0.076	0.006	11.653	0.001
Mean late summer (July, August, September) t° of the previous year	0.012	0.000	0.273	0.602
Mean t° from previous October to April	0.068	0.005	9.254	0.002
Mean t° of previous November and December	0.059	0.003	7.009	0.008
Total annual precipitation	0.025	0.001	1.251	0.263
Total annual precipitation of the previous year	0.011	0.000	0.232	0.630
Total precipitation from previous October to April	0.016	0.000	0.544	0.461
Total late summer (July, August, September) precipitation of the previous year	0.004	0.000	0.036	0.849
Total precipitation from previous December to February	0.024	0.001	1.175	0.278
Total precipitation of the previous and current growing seasons combined (May-August)	0.069	0.005	9.670	0.002

Results – correlation with climate variables – Summit Lake

Climate variable	R	R^2	F	p
Mean t°	0.079	0.006	13.121	0.000
Mean t° of the previous year	0.095	0.009	19.137	0.000
Mean late summer (July, August, September) t° of the previous year	0.004	0.000	0.033	0.855
Mean t° from previous October to April	0.083	0.007	14.649	0.000
Mean t° of previous November and December	0.080	0.006	13.675	0.000
Total annual precipitation	0.033	0.001	2.240	0.135
Total annual precipitation of the previous year	0.026	0.001	1.461	0.227
Total precipitation from previous October to April	0.017	0.000	0.605	0.437
Total late summer (July, August, September) precipitation of the previous year	0.009	0.000	0.158	0.691
Total precipitation from previous December to February	0.014	0.000	0.406	0.524
Total precipitation of the previous and current growing seasons combined (May-August)	0.084	0.007	14.793	0.000

Results – comparison of correlation coefficients



Things to do next

- Get meteodata from a closer location, if possible;
- Extend the analysis, including combined climate variables of temperature and precipitation
- Compare the climate responsiveness of the lodgepole pine height growth to that of the Scots pine in Latvia

Thank You for Your attention!

European Social Fond project (No. 2009/0200/1DP/1.1.1.2.0/09/APIA/VIAA/146)

Funded by the European Union

INVESTMENT IN YOUR FUTURE