Simon Poljanšek

A corresponding author, is trained dendroclimatologist, with interest in forest growth from mountainous, extreme sites and urban trees. He joined team as a PhD student in order to develop dendrochronological network in the western part of Balkan Peninsula, continued with sunshine reconstruction and investigating climatic signal of blue intensity and needle trace method on black pine. Currently, he investigates drought stress of urban trees in Ljubljana, Slovenia.

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Research areas

Department of forest yield and silviculture investigates tree physiology, cambium activity and climate-tree growth relationships in natural and urban forests. We use pinning method for annual growth investigations, needle trace method for needle shedding, Li-cor measurements for photosynthetic analysis and main parameters of tree-rings; tree-ring widths, density measurements, isotopic compositions.

Together with institutes and universities from Bosnia, Wales, USA, etc, we investigated needle shed process of two pine species, reconstructed temperatures, drought indexes and sunshine hours for regions on Balkan Peninsula, and studied oak die off and cambium activity of some tree species.

GOZDARSKI INŠTITUT SLOVENIJE
SLOVENIAN FORESTRY INSTITUTE

Dendroclimatological investigation of black pine (*Pinus nigra* Arnold) trees from hilly coastal area of Croatia

1860 SVEUČILIŠTE U ZAGREBU ŠUMARSKI FAKULTET 1669

Why this research?

Croatian hilly coastal area from north-eastern part of Adriatic Sea is characterized by limestone, Mediterranean climate, bora wind and black pine trees (*Pinus nigra* Arnold). Trees, growing in such environment, suffer summer drought stress as a result of shallow soil, low summer precipitation and high air and ground temperatures.

How

will the trees be affected by climate in the future? To answer this, we have to first investigate climate signal in tree-ring widths and maximum density.

Objectives

- Develop tree-ring width and MXD proxy chronology
- Calculate climate signal for each of the tested climate factor; air temperature, precipitation and sunshine hours
- Investigate time stability of the signal

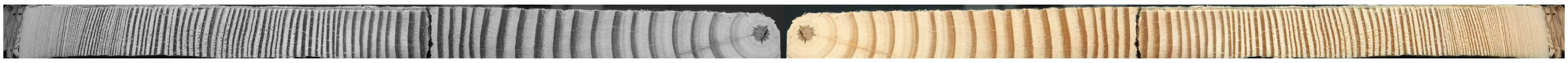
Main results

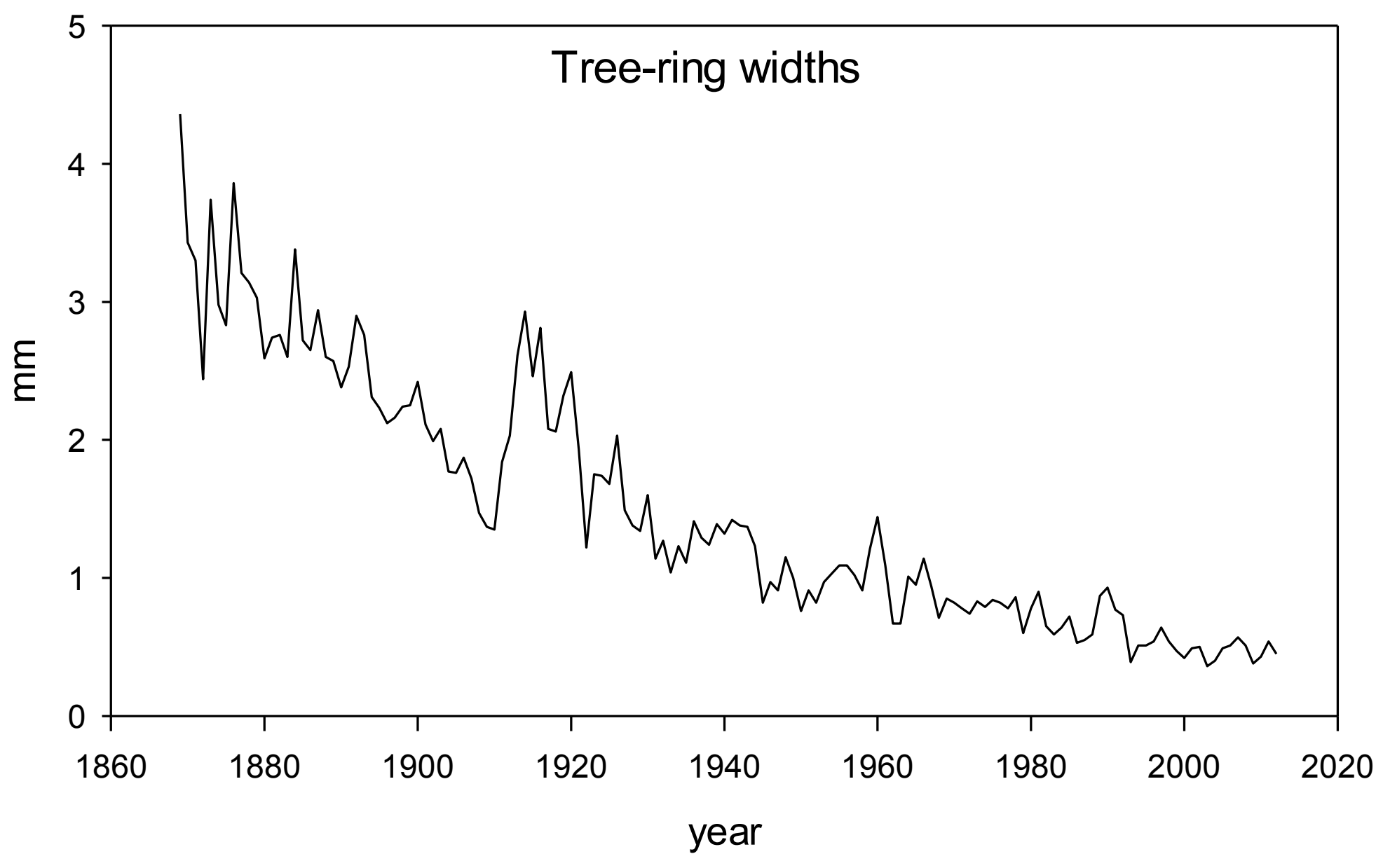
Developed site tree-ring width (TRW) and maximum latewood density (MXD) chronologies extend from 1869 till 2012. TRW chronology matches well with other black pine chronologies from surrounding regions, which makes it reliable for use in crossdating and dendrochronological network development.

Climate signal in TRW: Width of the tree rings was positively affected by June-July precipitation (r=0.34) and negatively by summer season temperatures (r=-0.32), while sunshine hours of individual months had no significant influence.

Climate signal in MXD: Above average number of sunshine hours had a strong and positive effect on latewood density in months from April till the end of June (r=0.51). Even stronger was influence of temperature in period April-August (r=0.68). Precipitation had negative influence in June and July (r=-0.33) on latewood density.

Climate signal stability: Tree-ring proxies reacted differently to climate factors through time. There were periods with strong response to climate factors and periods with insignificant response. The period with the least climatic influence was around 1930s and 1980s.

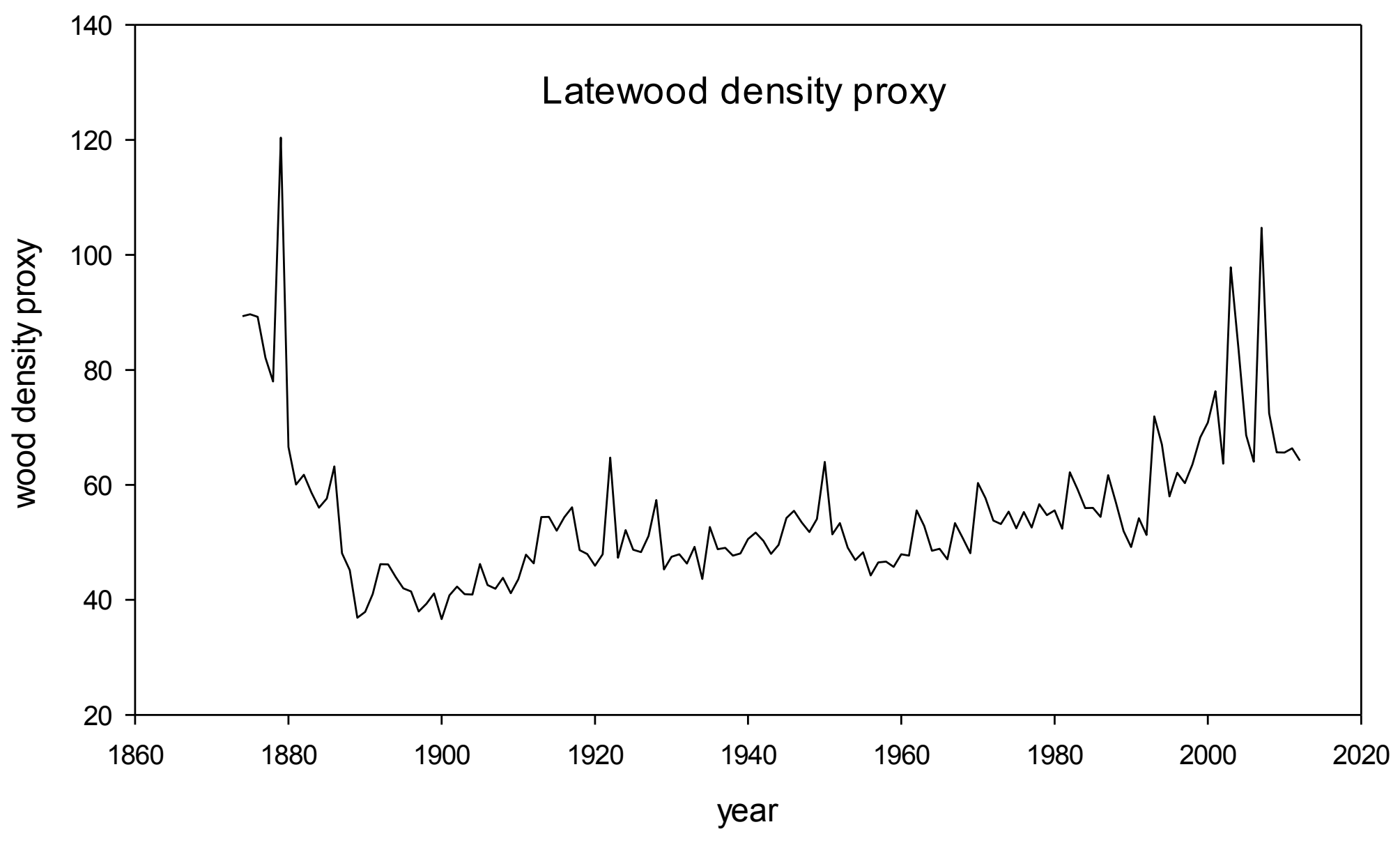




Age trend, seen in TRW, is interrupted around year 1910. One of the reasons is density reduction (probably tree mortality of understorey trees). As a result, remaining trees grew better in the next years and further on according to age trend.

precipitation		jan	feb	mar	apr	may	jun	jul	avg	sep	oct	nov	dec	period	
	trw	-0.16	0.04	0.04	-0.06	0.06	**0.26**	**0.27**	0.02	0.04	0.06	-0.08	0.02	**0.34**	JJ
	mxd	0.02	-0.02	0.00	-0.10	-0.05	**-0.28**	**-0.24**	-0.05	0.18	0.00	-0.12	-0.08	**-0.33**	JJ
temperature															
	trw	0.11	**0.20**	0.17	-0.01	**-0.20**	**-0.24**	**-0.27**	**-0.25**	-0.07	-0.06	-0.03	0.06	**-0.32**	MJJA
	mxd	**0.23**	0.18	**0.27**	**0.38**	**0.43**	**0.53**	**0.47**	**0.54**	0.17	0.17	**0.21**	0.12	**0.68**	AMJJA
sunshine															
	trw	0.20	0.13	-0.02	-0.03	-0.19	-0.23	-0.03	-0.21	0.14	0.02	0.12	-0.07	**-0.28**	MJ
	mxd	-0.08	0.16	0.02	**0.27**	**0.30**	**0.43**	0.15	0.19	-0.07	-0.34	0.05	0.05	**0.51**	AMJ

Correlation coefficients between all available climate data and trw; tree-ring width and mxd; latewood density. Bold values are significant with 95% reliability. Months included in periods are coloured with blue for precipitation, red for temperature and yellow for sunshine hours, while initials for periods stand for: JJ– June & July, MJJA– from May till August, AMJJA– April to august, MJ– May & June and AMJ-from April till July.



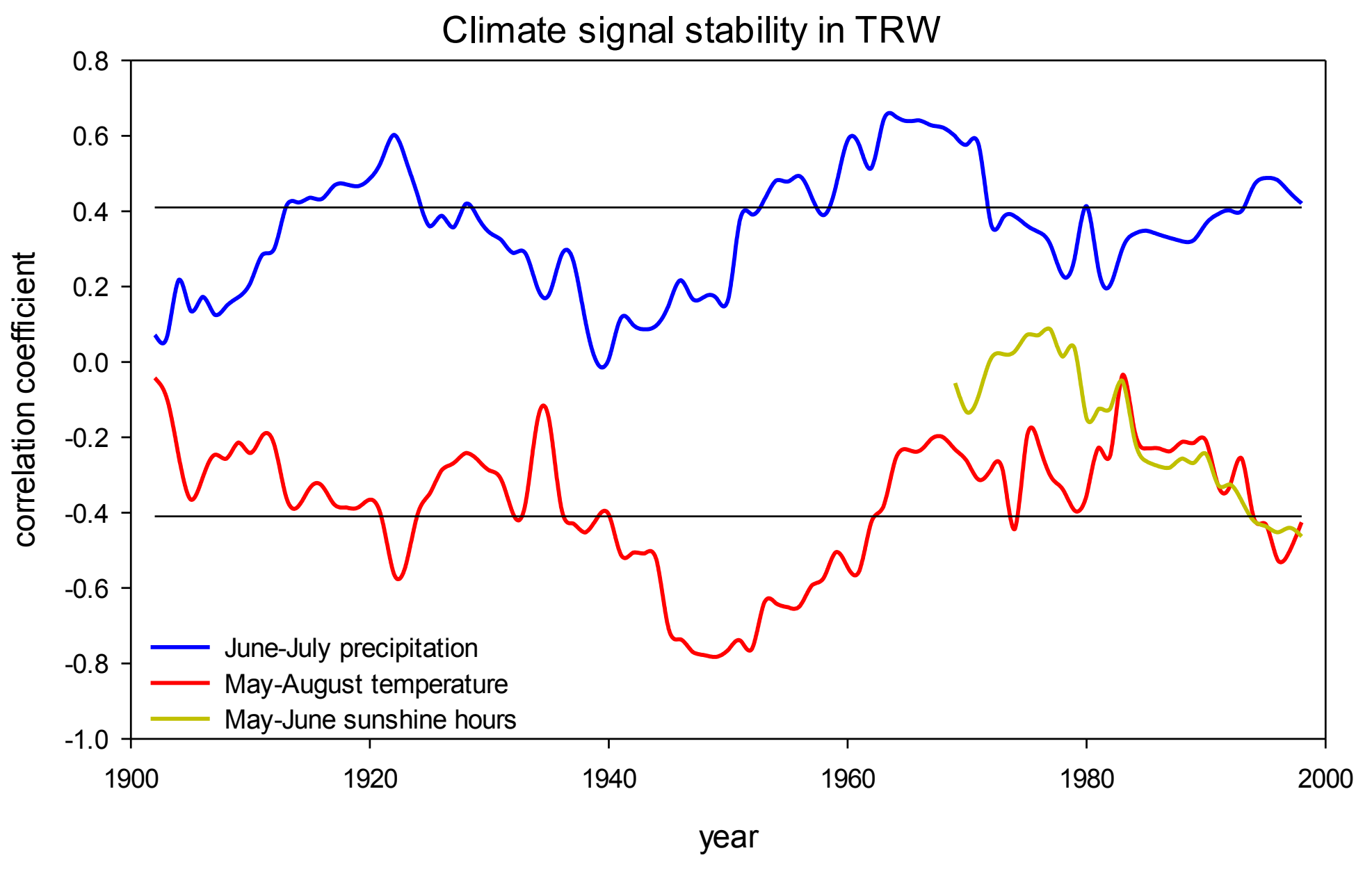
Higher values represent higher wood density and vice versa, but in general, measured blue intensity values are only proxy data for wood density.

Conclusions

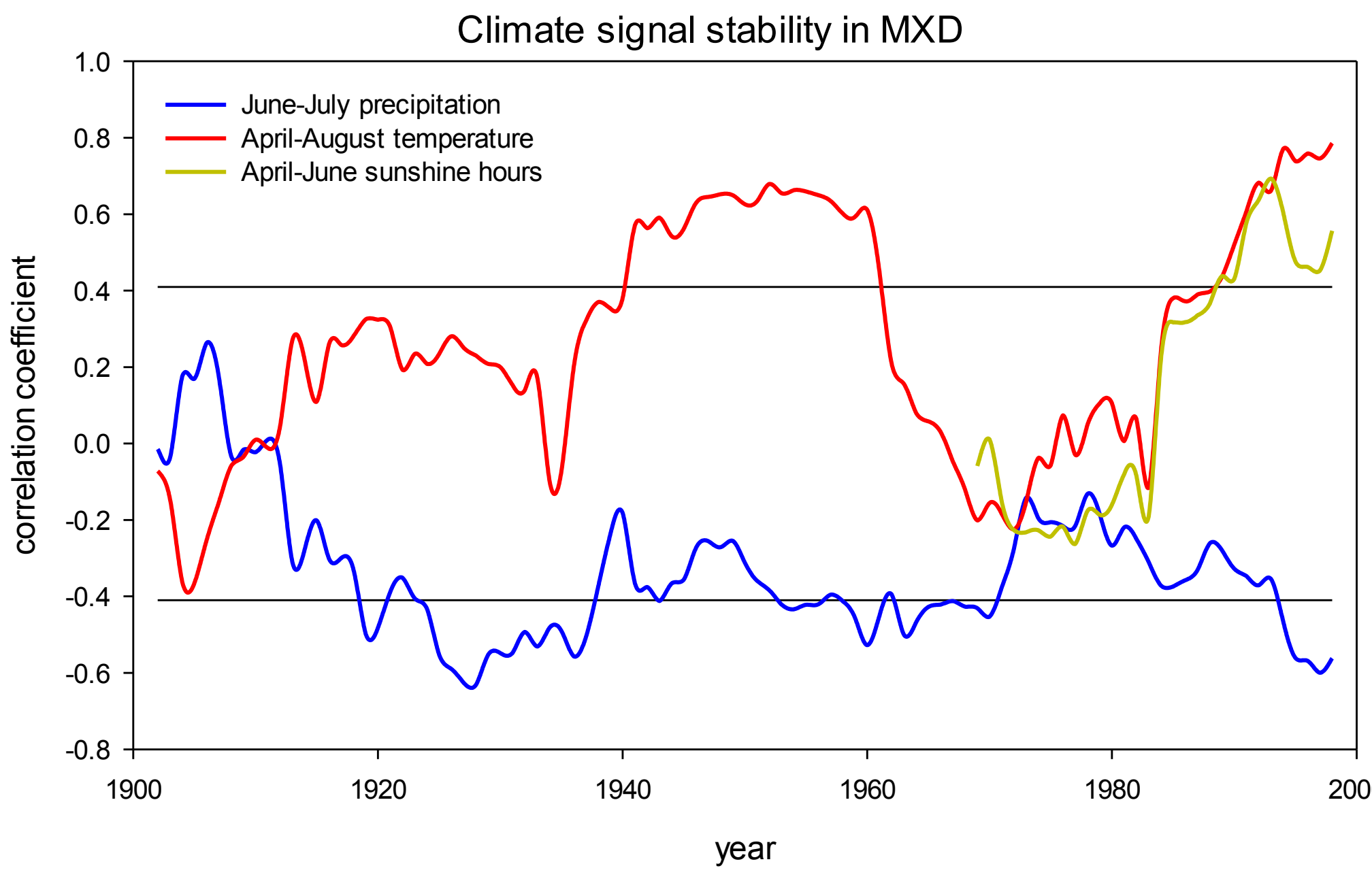
TRW react equally strong to late spring/summer precipitation, air temperature and sunshine hours, suggesting a complex climate signal. In the future, investigation of drought indexes should be included for TRW climate signal analysis from this area.

Higher correlation coefficients were calculated between climate factors and MXD data. The strongest influence was calculated between MXD and temperatures from April-August period, suggesting that for the wood density, this period is most important. Higher temperatures in this period could increase latewood density, but decrease widths of the tree-rings. Forest management strategies for this region need to take this facts into account.

Climate-tree growth relationship results are calculated for the period, but detailed look with running correlation reveals instability of the tree-growth reaction to climate factors. Further climate– tree data relationship investigations are necessary to discover, why trees change reaction to climate factors.



Signal is not stable in TRW or in MXD. Factors, which interrupted climate related stress, could be forest fires, reduced stand density, different cloud/cyclone regime, etc.



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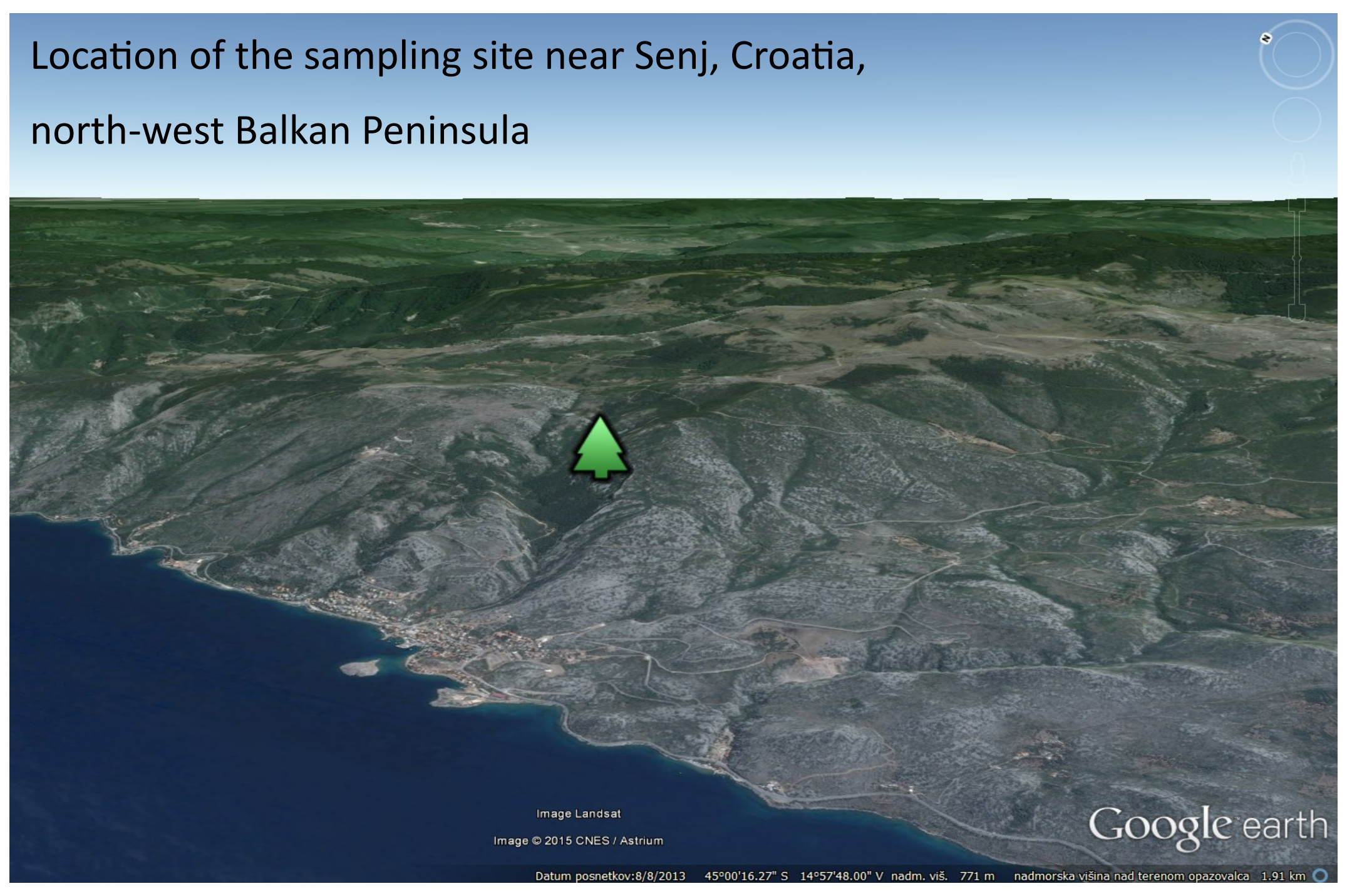
Location of the sampling site near Senj, Croatia, north-west Balkan Peninsula


One of the sampling sites